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MAY 1946

Engineers Seeking Realistic

ANSWERS TO AERONAUTIC PROBLEMS ARE CLAMORING FOR SOLUTIONS

REALISTIC analyses of engineering problems involving both commercial airliners and personal planes keynoted the SAE National Aeronautic Meeting in New York, April 3 to 5, when more than 750 members and guests registered for sessions distinguished by high quality of technical papers and nice balance of engineering interests.

Ranging from studies of German gasoline turbine and jet powerplants through down-to-earth considerations of airplane selection and theoretical considerations of future wing design, the meeting ended on a dramatic challenge when Gill Robb Wilson, *N. Y. Herald Tribune* aviation editor, called on aeronautic engineers to participate whenever possible in the fight for world peace.

"Your skills, imagination, and energy made our nation's winning air power possible," he pointed out. "Our enemies developed their technologies without moral considerations. You engineers must realize that you have succeeded in adding another and terrible dimension to warfare. As architects on the walls of time, history is going to hold you men partly responsible for a peace that must endure or our whole civilization will be lost as was that of Carthage and Cathay."

SAE President L. Ray Buckendale told his audience that the new SAE Technical Board's Aeronautics Committee has 322 projects under way, and that many more technical tasks of the Board in the fields of steel, non-ferrous metals, plastics and other subjects are of vital interest to aeronautical engineers and manufacturers.

"When you too-busy executives are asked to serve on some technical committee, delegate a junior engineer with proper qualifications to serve instead of begging off due to overcrowded schedules," he urged. "You and your organization will gain thereby.

"The country and industry are looking to the Society of Automotive Engineers for this type of cooperative effort," he concluded.

Probably no gathering of civilian engineers has ever been honored with as many high-ranking officers of the Army and Navy as was the dinner. Thirty-five general officers, including a general, two vice-admirals, three lieutenant-generals, two rear-admirals, and eight major-generals were among the guests, as were crew members of the B-29 bomber which razed Hiroshima with an atomic bomb. The group of heroes was headed by Col. Paul Tibbets.

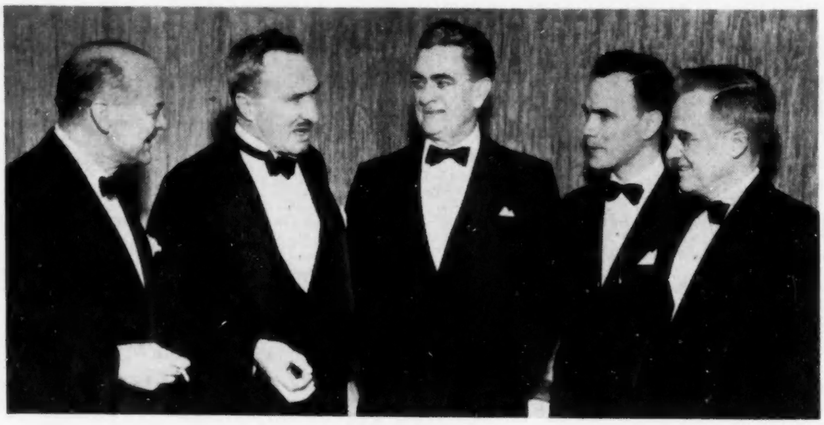
Capt. G. B. H. Hall, USN, and Col. H. G. Montgomery, Jr., members of the Working Committee of the Aeronautical Board, were among the speaker table guests, symbolizing the continuation of Government-Industry cooperative effort on aeronautical standards, materials specifications, and recommended engineering practices.

To the general committee of the three-day event goes the credit for planning one of the most successful national meetings in the Society's history. Chairman of the group was H. R. Harris, American Overseas Airlines, Inc. Serving with him were SAE Vice-President G. A. Page, Jr., director of engineering, Curtiss-Wright Corp.; SAE Vice-President E. A. Ryder, Pratt & Whitney Aircraft; SAE Vice-President Charles Froesch, vice-president, Eastern Air Lines, Inc.; Dr. A. L. Klein, Douglas Aircraft Co., Inc.; A. L. Beall, Wright Aeronautical Corp., and W. W. Davies, United Air Lines, Inc.

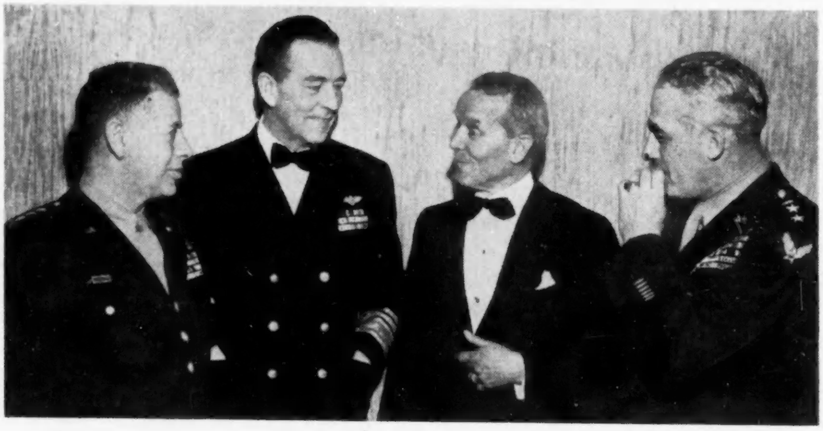
Another feature of the dinner was the presentation of the Wright Brothers Medal of 1945 to Myron Tribus, formerly a captain in the AAF, and now at the University of California, Los Angeles. The award was

First of five "See Greater New York" flights made by SAE members and guests on April 6 at LaGuardia Airport. The flights, provided through the courtesy of American Airlines, Pennsylvania Central, Eastern, Trans-Canada, United, Transcontinental & Western, and Pan American, were arranged by Chairman R. Dixon Speas of SAE Metropolitan Section

Photo by Cliff Lefferts, American Airlines.



Participants in the SAE National Aeronautic Meeting's dinner were Gill Robb Wilson, "New York Herald Tribune"; General Chairman H. R. Harris; SAE President L. Ray Buckendale; R. Dixon Speas, chairman of Metropolitan Section, and Toastmaster Robert Ramspeck, executive vice-president, Air Transport Association of America



Among the distinguished guests at the SAE National Aeronautic Meeting, April 3-5, at the Hotel New Yorker were Gen. G. C. Kenney, commanding general, Strategic Air Command; Vice-Admiral A. W. Radford, USN, office of the Chief of Naval Operations; Vice-Admiral E. S. Land (retired), president of the Air Transport Association of America and a former chairman of the SAE Aeronautic Standards Committee, and Lt.-Gen. N. F. Twining, commanding general, Air Technical Service Command

presented by Mr. Page, chairman of the Award Board, and was made for the author's paper "Report on Development and Application of Heated Wings."

A feature of note was the extensive exhibit of captured German and American turbine and jet powerplants, provided through the courtesy of the Army and Navy.

FIDO, the fog dispersal equipment developed in England and now being further improved by a joint military and industry project at Arcata, Calif., was displayed in scale models through the courtesy of T. B. Rendel, Shell Oil Co. A British film, provided by Sir William Wisemann, wartime director of petroleum production, was shown, and Com. Robert L. Champion, USNR, explained the various systems in detail.

Several airline executives hailed the Navy's decision to turn the Arcata establishment over to a steering committee composed of Army, Navy, Civil Aeronautics Board, Air Transport Association, and other interests to accelerate developments of all-weather flying. Besides the project on fog dispersal equipment, radio, airport lighting, and radar will be studied under the aegis of the steering committee.

AIRCRAFT Sessions

CHAIRMEN

R. R. Higginbotham, Republic Aviation Corp. — **Ralph H. Upson, New York University**

Fred E. Weick, Engineering & Research Corp. — **John G. Lee, United Aircraft Corp.**

AERONAUTIC engineers are shaping their thinking and planning their test programs in terms of superspeed aircraft. They are discovering, the Aircraft Sessions showed, that their thinking and their work require many revisions, because the design of aircraft for high-speed operation is something more than mere extrapolation of low-speed operation.

It is being found necessary, it was disclosed, to develop and determine the characteristics of new types of wing structure that are better able to withstand the crushing forces that occur at these high speeds. New wing shapes must lessen high-speed control problems, drag increase, and instability.

Installation problems of the high-powered engines that these high-speed planes require took their share in the spotlight. When air-cooled engines are used they must be both cooled and enclosed so that they don't offer excessive drag. This problem has been solved, according to one expert, by judicious use of cowls and flaps to direct the air over the engine fins without increasing drag any more than possible.

Sweptback Wings

Airplanes with conventional wings are being limited to 75-85% of the speed of sound because of their tendency to go into uncontrollable dives at these speeds, due to radical changes in the flow of air over the wings. The use of sweptback wings to increase this critical speed was discussed by Hartley A. Soulé of the NACA in his paper "Stability Problems with Swept Wings."

First suggested in 1941 by a German, and then later thought of independently by R. T. Jones of the NACA, the idea seems to offer much promise, but poses many difficult problems for the aerodynamicists to solve.

In designing the swept wing, Mr. Soulé pointed out, angles of sweep must be of the order of 40-45 deg for some appreciable gain to be made. Almost no gain is realized, he said, with sweep angles under 30 deg.

Wing-tip stalling, one of the problems being encountered with sweptback wings of high aspect ratio, has made it necessary to evolve means for improving the lift characteristics of tip portions.

Ralph Upson of New York University mentioned that sweep sometimes entered into low-speed problems as well as the high-speed problems discussed by Mr. Soulé; for instance, wings of low-speed planes are

sometimes swept forward to get satisfactory aerodynamic characteristics.

Maximum Lift at High Mach

From the data of high-speed, high-altitude operation it can be seen that Mach and Reynolds numbers have interrelated effects on the maximum lift coefficient that need studying. A paper entitled "An NACA Flight and Wind Tunnel Investigation of Maximum Lift as Affected by Variations of Mach and Reynolds Numbers," by John R. Spreiter and Paul J. Steffen of NACA (and presented by Mr. Spreiter) gives results of an investigation that is helping to fill this gap in our knowledge.

This most comprehensive investigation was carried out with six airplanes having both conventional and low-drag airfoils, as well as with models in several wind tunnels. Good correlation existed between the flight and wind tunnel data, which were obtained in gradual stalls covering a range of Mach numbers of 0.15-0.72 and of Reynolds numbers of 4,400,000-19,500,000.

At subcritical Mach numbers, the authors reported, the maximum lift coefficient obtainable in gradual stalls decreased steadily with increasing Mach number for all the airplanes tested.

In the supercritical Mach number range, the speakers reported, the gradual stall maximum lift coefficient of conventional airfoils continued to diminish with increasing Mach number, while that of low-drag airfoils reached a minimum at a Mach number between 0.40-0.55 and then began increasing until secondary peak values were reached at a Mach number between 0.60-0.66.

Magnesium Alloys

A widespread belief that magnesium will burst into flame almost without provocation – a misconception that certainly wasn't allayed by the wartime use of the ribbon and powder for flares and incendiaries – has been one of the factors that has hindered the use of much magnesium for aircraft structures. Actually, as J. C. DeHaven of Battelle Memorial Institute pointed out in his paper, "The Development of Magnesium Alloys as Aircraft Materials," the fire hazard is not nearly as great as is believed, and with the addition of very small amounts of beryllium – limited by the solubility of beryllium in magnesium, which is 3/100 of 1% – the burning characteristics of the metal are inhibited to such an extent that even magnesium sheet, which had presented the greatest problem, becomes no more inflammable than steel sheet.

Myron Tribus, 1945 Wright Brothers Medalist, receiving the award from Chairman George A. Page, Jr., of the Award Board, and SAE vice-president for aircraft engineering. Mr. Tribus (left) won the award for his paper on "Report on Development and Application of Heated Wings"

Mr. DeHaven also said that coatings could be used to reduce the hazard, in reply to a question by Mel Young, Wright Aeronautical Corp., although he asserted that these were not as effective as beryllium. This statement was questioned by John C. Mathes, Dow Chemical Co., who thought that zinc borate primer was as effective as beryllium addition in reducing the fire hazard.

Excessive corrosion appears to be hurdled, according to the author, by the perfection of very high purity magnesium alloys and superior fluxes, along with improved metal handling methods.

These high purity castings, containing little or no zinc, will find increasing usefulness, Mr. DeHaven said, because they require fewer risers and are easier to heat-treat than the high zinc-containing alloys.

The author told of one cast alloy that has been developed that contains cerium and manganese. It retains very good properties at as high as 600 F. Other experimental alloys are being developed that show even better room- and elevated-temperature properties.

Advances have also been made in regard to anodic coatings and paint systems, forming and welding techniques, and resistance to stress-corrosion cracking, this latter being brought about, Mr. DeHaven said, by a three-fold study of rolling and heat-treating schedules, alloy composition, and cladding with pure magnesium, or a resistant alloy.

That modern magnesium alloys can be applied successfully to a major structural part was shown by the second paper presented at the session of aircraft metals. "A Summary of Design and Test Experience with Monocoque Magnesium Wings," by John C. Mathes of Dow Chemical Co., and Earl Rottmayer of the University of Michigan (presented by Mr. Mathes), told the story of the design and testing program that was organized for the manufacture of a full-size monocoque magnesium wing for the PV-1 airplane.

The authors pointed out that the simplified construction would reduce production costs, and the rigid, nonbuckling surface skin would be more efficient aerodynamically, particularly as aircraft speeds increase. Magnesium is particularly well suited for this type of structure, Mr. Mathes said, because its low density makes it highly efficient for structures where elastic stability is an important factor in strength.

If aircraft are to achieve in the next four

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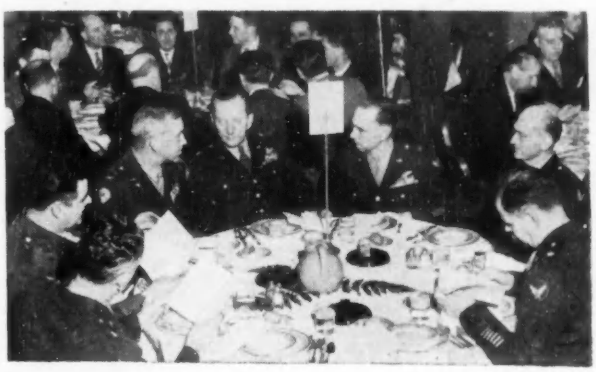

A few of the top-ranking military aviation officers who attended the SAE National Aeronautic Meeting dinner are shown here. The officers included Gen. G. C. Kenney, commanding general, Strategic Air Command; Vice-Admiral A. W. Radford, office of the Chief of Naval Operations; Lt.-Gen. N. F. Twining, commanding general, Air Technical Service Command; Lt.-Gen. H. S. Vandenberg, assistant chief of staff, AAF; Lt.-Gen. L. H. Brereton, commanding general, Third Air Force; Rear-Admiral H. B. Sallada, USN, chief, Bureau of Aeronautics; Rear-Admiral L. C. Stevens, chief, Engineering Division, Bureau of Aeronautics; Major-Gen. Hugh J. Knerr, secretary general, Air Board; Major-Gen. B. W. Chidlaw, deputy commander for Engineering, Air Materiel Command; Major-Gen. L. S. Kuter, commanding general, Atlantic Division, ATC; Major-Gen. R. W. Douglass, Jr., commanding general, First Air Force; Major-Gen. J. W. Jones, Air Inspector; Major-Gen. R. L. Walsh, special assistant to the Commanding General, AAF; Major-Gen. Follette Bradley (retired assistant to the president, Sperry Gyroscope Co.); Major-Gen. H. C. Davidson, director, AAF Aid Society; Brig.-Gen. R. C. Hood, deputy chief, Air Staff; Brig.-Gen. Leon Johnson, chief of Personnel Division, AAF, and leader of the first bombing attack on the Ploesti oil fields for which he was awarded the Congressional Medal of Honor; Brig.-Gen. G. C. Jamison, deputy assistant chief of Air Staff; Brig.-Gen. E. W. Rawlings, chief of Procurement Division, Air Materiel Command; Brig.-Gen. J. G. Williams, chief of Flight Operations Division; Brig.-Gen. G. C. McDonald, assistant chief of Air Staff, Intelligence; Brig.-Gen. R. K. Taylor, chief of administration, Air Materiel Command, and Brig.-Gen. A. E. Jones

French Lick Springs Hotel, French Lick, Ind.

SAE SUMME M

PROGRAM

Monday, June 3

9:30 A.M. — Transportation and Maintenance

Which Driver for the Job?
- Prof. A. E. Neyhart, Pennsylvania State College

Prepared Discussion by:
- D. M. Goodwillie, Willett Co.
- R. J. Olson, Fred Olson & Son Motor Service Co.

9:30 A.M. — Passenger Car

Potentialities of the New Fuels in the Design of Passenger Car Engines
- Earl Bartholomew, Ethyl Corp.

An Independent Four-Wheel Suspension – With Rubber Torsion Springs
- A. S. Krotz, R. C. Austin and L. C. Lindblom, B. F. Goodrich Co.

2:00 P.M. — Truck and Bus

Truck Design from the Operator's Viewpoint

Intercity Service – Eastern States
- T. V. Rodgers, American Trucking Assns., Inc.

Intercity Service – Central States
- H. F. Chaddick, American Transportation Co.

Intercity Service – Western States
- J. L. S. Snead, Jr., Consolidated Freightways, Inc.

Local Trucking Service
- W. D. Bixby, H. H. Earl and R. M. Werner, United Parcel Service of N. Y., Inc.

8:30 P.M. — Passenger Car

The Performance of European Economy Cars
- Laurence Pomeroy, Temple Press, Ltd.

Minimizing Horse Power Requirements of Motor Vehicles
- John Andreau and Alex Taub, Matam Corp.

Tuesday, June 4

9:30 A.M. — Truck and Bus

Bus Design from the Operator's Viewpoint

Intercity Service
- T. L. James, Burlington Transportation Co.

City Service
- A. F. McDougald, Capital Transit Co.

9:30 A.M. — Aircraft Powerplant

Aircraft Engine Starters
- A. R. Beier, Jack and Heintz, Inc.

The Fuel Air Ratio Required for Constant-Pressure Combustion of Hydrocarbon Fuels
- N. A. Hall, United Aircraft Corp.

Light Aircraft Service Experience with All-Purpose Fuel
- R. V. Kerley, Ethyl Corp.

9:30 A.M. — Materials

Classification of Rubber and Rubber Compounds
- G. H. Swart, General Tire & Rubber Co.

Automotive Glazing with Plastics
- G. B. Watkins and J. D. Ryan, Libby-Owens-Ford Glass Co.

2:00 P.M. — Aircraft Powerplant

Graphical Solution for the Performance of Continuous-Flow Jet Engines
- R. E. Bolz, National Advisory Committee for Aeronautics

Methods of Presenting Performance Data on Aircraft Gas Turbines for Jet Propulsion
- H. C. Towle, Jr. and E. L. Auyer, General Electric Co.

2:00 P.M. — Transportation and Maintenance

Shop Layout and Equipment for a Large Fleet
- E. W. Templin, Los Angeles Dept. of Water & Power

Prepared Discussion by:
- Frank Ward, Surface Transportation Corp.

8:30 P.M. — Truck and Bus and Passenger Car

German Automotive Developments (Report from Automotive Sub-Committee of TIIC)

Introduction
- O. D. Treiber, Hercules Motor Corp.

Small Engines
- Stephen duPont

Air-Cooled Engines
- A. M. Madle, Briggs and Stratton Corp.

Gasoline Engines
- A. W. Pope, Jr., Waukesha Motor Co.

Diesel Engines
- R. C. Mathewson, American Bosch Co.

Electrical Equipment
- A. J. Poole, Scintilla Magneto Div., Bendix Aviation Corp.

Clutches and Transmissions
- E. F. Norelius, Allis Chalmers Co.

Chassis
- A. M. Wolf, Consulting Engineer

Sunday, June 2 . . . .

Plan to attend this big family party that officially opens the meeting . . . Program sponsored by the SAE Air Transport Engineering Activity

MEETING

(Semi-Annual)

June 2-7

PROGRAM

Wednesday, June 5

9:30 A.M. — Materials

Aluminum Brazing Development
- L. P. Saunders and P. S. Rogers, Harrison Radiator Division, General Motors Corp.

Some Recent Trends in Alloy Steels
- R. S. Archer, Climax Molybdenum Co.

9:30 A.M. — Aircraft Powerplant

Cyclone 18 Performance in Combat Areas – A Record of Operational Engineering to Establish Optimum Performance
- S. R. Kent, Wright Aeronautical Corp.

Effect of Atmospheric Conditions Upon the Performance of Engines, Turbines and Jets
- F. W. Disch, Boeing Aircraft Co.

2:00 P.M. — Field Day

8:15 P.M.

Business Session

●

Celebration Commemorating the GOLDEN JUBILEE OF THE AUTOMOTIVE INDUSTRY

8:30 P.M. — Body

Design: Accidentally or On Purpose
- R. E. Bingman, Designer

Thursday, June 6

9:30 A.M. — Diesel Engine

Load-Carrying Capacity of Journal Bearings
- A. F. Underwood and J. M. Stone, Research Laboratories, General Motors Corp.

Aluminum Alloys for Bearings
- H. Y. Hunsicker and L. W. Kempf, Aluminum Co. of America

Prepared Discussion by:
- E. L. Dahlund, Fairbanks, Morse & Co.
- G. E. Burks and G. B. Grim, Caterpillar Tractor Co.

9:30 A.M. — Air Transport

Symposium – Potential and Realized Economies in Air Transportation

Simplifying Terminal Problems
- S. J. Solomon, Atlantic Airlines, Inc.

Operating Cost Aspects of Airline Procedure
- R. D. Speas, American Airlines, Inc.

Economic Controls in Air Transportation
- H. E. Nourse, United Air Lines, Inc.

2:00 P.M. — Aircraft Powerplant

Possibilities of the Turbo Jet Powerplant
- P. B. Taylor and S. T. Robinson, Consulting Engineers

8:30 P.M. — Diesel Engine

Survey of German Diesel Engine Development
- C. G. A. Rosen, Caterpillar Tractor Co.

Prepared Discussion by:
- Com. W. W. Brown, Officer in Charge, Diesel Section, Bureau of Ships, Navy Dept.
- Gordon Murphy, Fairbanks, Morse & Co.

Friday, June 7

9:30 A.M. — Fuels and Lubricants

A Visual Study of Cylinder Lubrication
- M. C. Shaw and T. J. Nussdorfer, Jr., National Advisory Committee for Aeronautics

Piston Lubrication Phenomena In a Motored Glass Cylinder Engine
- S. J. Beaubien and A. G. Cattaneo, Shell Development Co.

Analysis of a Shock – Excited Transient Vibration Associated with Combustion Roughness
- A. S. Fry, John Stone and L. L. Withrow, Research Laboratories Div., General Motors Corp.

2:00 P.M. — Fuels and Lubricants

Symposium on Gear Lubricants

Recent Developments in Gear Lubricants
- P. V. Keyser, Jr., Socony-Vacuum Oil Co.

High-Speed Testing of Lubricants for Hypoid Rear Axles
- C. E. Zwahl, Chevrolet Motor Div., General Motors Corp.

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. . . . BANQUET

7:00 P.M.

William Littlewood, Toastmaster

L. Ray Buckendale, SAE President

"Strategic Bombing of Germany" (Illustrated)

– Dr. Stephen J. Zand, Sperry Gyroscope Co.

News..
..OF THE SOCIETY

Aero Parts Packaging Task Speeded by SAE Committee

THE SAE Aeronautics Division's newly reorganized committee on preservation and packaging of aeronautical parts and equipment is speedily gearing its efforts to modernize and centrally locate in one volume – for commercial application – all data on aeronautical standards, material specifications and recommended practices on preservation and packaging developed and prepared by several SAE committees during the war period.

It is apparent that with the uncertainties of combat conditions, such as destination and length of storage together with the extreme climatic changes to which aircraft equipment was subjected in transportation to battle zones, utmost precaution in resisting corrosion was mandatory. However, in commercial operations where all factors are determinate, preservation and packaging can be conducted more economically by applying only those measures necessary to satisfy the one particular set of known conditions.

Designated SAE Committee S-6, Preservation and Packaging of Aeronautical Equipment and Parts, the new committee will act as a steering committee and will prepare specifications, standards, and recommended practices applicable to commercial packaging of all aeronautical equipment. Practical application of these standards and specifications will be the responsibility of Subcommittee S-6A, Packaging of Aeronautical Parts and Equipment. Membership of the committee will be composed of specialists in the following phases of aeronautics: large aircraft engines, small aircraft engines, propellers, accessories and equipment, airlines and one East coast and one West coast airframe technician.

Committees S-6 and S-6A, in embarking on their ambitious program, will review the progress made by three previous committees in preservation and packaging of:

1. engines
2. engine spare parts
3. accessories and equipment

The basic criteria already developed in these categories will serve as the framework upon which the modernized version will be built.

Development of methodized and simplified engine preservation and packaging was first initiated by the SAE in the spring of 1941 at the request of the Office of Production Management and, through the efforts of old Committee E-9, Preservation of Engines, resulted in the publication of 18 Aeronautical Standards and 18 Material Specifications which served as the basis for all subsequent developments by other groups.

Dehydrating agents, one specification states, should be provided for both the cylinders and crankcase to remove by hygroscopic action any entrapped moisture. A standard cylinder dehydrator plug containing a silica gel desiccant was devised for installation in the spark plug openings. Similar dehydrator plugs were specified for installation in other openings to the interior of the engine such as the oil sump opening.

The packaging procedure further recommended covering the propeller shaft with a coat of preservative oil and greaseproof paper wrapping, uniformly distributing bags of dehydrator agent around the engine at the approximate rate of one pound per cylinder and securing a humidity indicator card to the engine for visual indication of humidity conditions. The complete engine is enclosed in a moisture-proof, laminated plastic envelope which is evacuated to eliminate entrapped moisture and then heat sealed.

During the war, this lengthy and costly procedure was necessary for all engines to insure resistance to corrosion. Committee S-6 will revise this procedure, making for more economical processing since there are fewer factors to contend with in commercial practice.

The preservation and packaging phase dealing with engine spare parts was consolidated by old Committee E-9A, Preservation and Packaging of Engine Parts, in Aeronautical Recommended Practice ARP 197A. It covered, in chart form, preparatory cleaning, method of application of the preservative coating and the packaging and boxing

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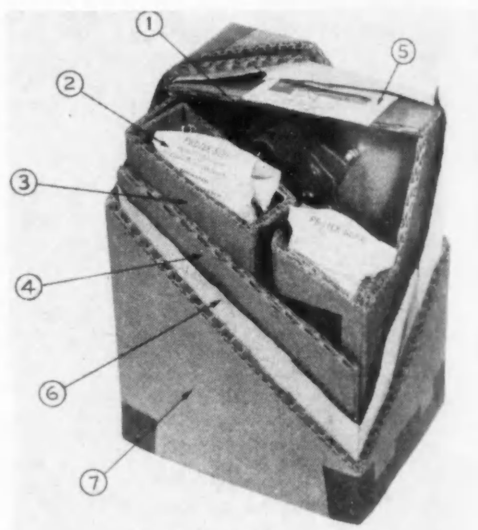

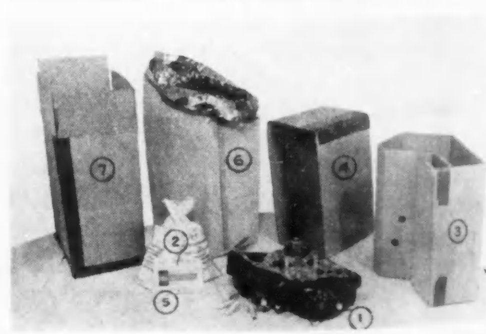

Dehydration packaging of an accessory drive assembly using a metal foil moisture-vapor barrier. (1) Accessory drive assembly; (2) dehydrating agent; (3) corrugated fiberboard insert; (4) corrugated fiberboard sleeve; (5) humidity indicator card; (6) moisture-vapor barrier; (7) corrugated fiberboard container

Soil Test Has Army Priority

CONTINUED activity of the SAE Technical Tractor Committee's war program on controlled soil testing is an apparent necessity in view of the high priority given by Army Ordnance to postwar activity in vehicle mobility testing.

Early experience in the war reemphasized that conditions of terrain and soil limited operations of military vehicles and jeopardized the success of planned ground operations due to unforeseen changes in soil conditions and insufficient knowledge of the soil itself with resultant immobilization of vehicles in mud. Just as exhaustive studies were necessary to learn and understand the behavior of air and water in designing aircraft and sea-going ships, a similar knowledge of soil is required to develop and design ground vehicles for operation under all conditions.

The Controlled Soil Testing Subcommittee, organized at the request of the Ordnance Research Center at Aberdeen, functioned as an advisory group to the services on Army test procedures and on evaluating the test results. The committee issued a series of four progress reports in which recommendations for testing vehicle mobility were outlined with the major objective of improving cross country performance of military vehicles.

These tests were conducted by the Army on numerous types of soils in various localities throughout the country in an attempt to analyze the accumulated data and arrive at a rational soil-vehicle relationship. Vehicle mobility, it is believed, is largely dependent upon flotation, the ability of the unit to stay on or near the surface of the terrain and upon traction. Various soils were studied to determine the bearing of soil characteristics on flotation and traction and the following soil properties, it is felt, have a considerable effect on mobility:

1. Plasticity
2. Shear strength
3. Density
4. Cohesion
5. Adhesion

Plasticity is the property of the soil to deform under stress without rupture and is governed by clay and moisture content. At the lower plastic limit, the soil has just enough moisture within itself to bind the particles into a cohesive mass. The upper plastic limit represents the point at which the moisture content changes the soil from a cohesive mass to a fluid state. Mud for example, is a soil condition approaching the upper plastic limit. A tire or track going through mud will sink until it reaches a solid base or until sufficient contact area is gained for support.

The second property, shear strength, is the slipping of soil over soil based on the internal resistance of the soil to the movement of its particles. It is proportional to the applied vertical pressure and is at a maximum at the lower plastic limit. The tractive effort of a wheel or track seems to be a function of the soil shear value which is apparent from the analogy of the track and soil to a gear and rack. To ascertain soil reaction, laboratory tests were conducted to establish shear planes using a

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THE SAE Tractor Technical Committee has been organized by the SAE Technical Board to succeed the Tractor War Emergency Committee.

Common problems of the tractor industry during the war period, such as material shortages and military requirements, demonstrated need for a coordinated effort of industry and government which gave rise to the TWEC. The resultant benefits of this activity to the industry merited its continuation for cooperative consideration of peacetime problems peculiar to the industry. Among the TWEC projects to be continued by the TTC are:

- Controlled Soil Testing,
- Tractor Tires
  - a. Front Tire Sizes,
  - b. Tire Simplification.

A new project being undertaken by the committee is the study of rice and cane field tires. The Tractor Fuel Classification program, inaugurated by the TWEC, is in the final stage of completion.

The membership of the SAE Technical Tractor Committee, as constituted by the Technical Board, is as follows: Chairman E. McCormick, John Deere Tractor Co.; J. M. Davies, Caterpillar Tractor Co.; L. A. Gilmer, Oliver Corp.; D. C. Heitshu, Harry Ferguson, Inc.; L. S. Pfost, Massey-Harris Co.; O. R. Schoenrock, J. I. Case Co.; C. A. Hubert, International Harvester Co.; A. W. Lavers, Harry Ferguson, Inc.; W. F. Strehlow, Allis-Chalmers Mfg. Co., and E. G. Van Zee, Minneapolis-Moline Power Implement Co. With the exception of Mr. Hubert, all of the above mentioned members served on the old TWEC.

Tractor Fuels Classification

THE tractor fuel classification project, now in the final stage of completion, was inaugurated by the Tractor War Emergency Committee with the object of arriving at requirements for two tractor distillate fuel categories, light fuel and regular fuel, and at the same time establish a technical basis for uniform state tax regulations on tractor fuels.

The purpose of fuel classification was to arrive at an economical fuel which would give the most efficient performance. A secondary advantage in standardizing fuel classifications is the possibility of engine manufacturers standardizing compression ratios and carburetor settings.

Considerations of major importance in classifying fuels are its minimum octane rating and volatility. In establishing a value of volatility, the temperature for the 10% and 95% distillation points were set as criteria.

To evaluate the effect of volatility and fuel octane number on engine performance, cooperative tests were conducted under the

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3 Projects on Tractor Tires

IN embarking on its postwar program, the SAE Technical Tractor Committee, formerly the SAE Tractor War Emergency Committee, will devote considerable study to the following phases of tractor tire problem:

1. Front Tire Sizes,
2. Tire Simplification,
3. Rice and Cane Field Tires.

The problem of improving and standardizing front tractor tire sizes was undertaken by the TWEC in the summer of 1945 because front tires in use were found to be inadequate to carry loads such as manure spreaders, hay loaders and other implements attached to the front loader. Front tractor tires are replaced more often than rear tires and overloads of 200% to 300% are frequently encountered.

Several aspects considered in providing a more satisfactory front tire are widening the tire, increasing tire pressure, and increasing tire ply.

Although a wider tire will increase load-carrying capacity, it may at the same time defeat the purpose of a narrow, single row tractor and also require a new rim design.

Higher pressures, to be safely applied, will require 6 and perhaps 8 ply tires instead of the present 4 ply. Utilization of rayon cord in place of cotton would make possible greater body strength with fewer plies.

It is cautioned by the committee that with the virtues of improved front tractor tires, greater loads will be imposed with possible failure of parts such as bearings, spindles and axles which are not primarily designed to withstand overload conditions.

Experimental tests are now being conducted to study the effects of the above proposed improvements for inclusion in a more satisfactory tire. Considerable research is still required to determine tire life under various types of service.

The second tire project, simplification of tractor tire listings, is as urgent a need now as it was during the war, according to a request from the Rubber Manufacturers Association for continued participation of the SAE-TTC as an advisory group to the RMA in representing the technical viewpoint of the tractor industry.

Immediate wartime demand for keeping tire requirements down to the least number of sizes and plies arose from the need for rubber and labor conservation. However, perennial benefits of limiting the variety of tire sizes can be accrued by both the producer and user alike since rubber companies require fewer molds and fabricating machines, inventories are reduced and the farmer's cost of replacing tires is obviously lessened.

In performing its war service, the old committee established a basis for reducing the number of tire sizes in use and "served an unusual, worthwhile function" according to the RMA. Setting up the list was accomplished by determining the most popular tire sizes used by the tractor manufacturers and by noting those sizes in greatest use according to sales reports of tire manufacturers. The lists were revised and brought up to date as the need arose.

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Detroit Section Expands

DETROIT Section has received authority to add to its territory the counties of Tuscola, Gratiot, Clinton, Midland and Bay. At the same time, the Governing Board has authorized formation of a Division of the Section in the Saginaw area, so that it will be possible for members in the northern part of Section territory and in the five additional counties to attend regular meetings.

E. R. Wilson, Chevrolet Motor Division, General Motors Corp., has been appointed by the Detroit Section Governing Board to the office of regional vice-chairman for the new Saginaw Valley area Division for the remainder of the Section year. In future the office will be elective.

To Study Section Financing

SECTION Committee Chairman R. F. Steeneck has been named chairman of a special committee appointed by SAE President L. Ray Buckendale to review Society policies on financing of SAE Sections.

Serving with Mr. Steeneck on the special committee are R. J. Waterbury, vice-chairman of the Sections Committee; A. T. Colwell, chairman of the Finance Committee; B. B. Bachman, SAE Treasurer, and W. S. James, chairman of the Publication Committee.

Truman Names SAE Members

AMONG the SAE Members appointed by President Truman as members of the Engineering Committee of the President's Highway Safety Conference, to meet May 9 to 11 in Washington to work on the problem of the increasing highway safety hazards are:

H. H. Allen, Interstate Commerce Commission; B. B. Bachman, vice-president, the Autocar Co.; Donald Blanchard, secretary, SAE Technical Board; J. M. Crawford, General Motors Corp.; Dr. H. C. Dickinson, formerly an executive of the National Bureau of Standards; Harold F. Hammond, American Transit Association; F. C. Horner, General Motors Corp.; W. S. James, Ford Motor Co.; Theodore M. Matson, Yale Bureau of Highway Traffic; James J. Shanley, New Jersey Department of Motor Vehicles; Harold S. Vance, chairman, Studebaker Corp.; Don K. Wilson, New York Power & Light Corp., and J. C. Zeder, Chrysler Corp. Messrs. Bachman, Crawford, Dickinson, and James are past-presidents of the Society. Col. Light B. Yost, Federal Works Building, Washington, is executive secretary of the Conference.

Twin City Gains Section Status

STATUS of the Twin City Group has been advanced to that of Section, by action of the Council. Since its organization in 1943, Twin City membership has increased from 43 to over 100. There are in addition 30 SAE enrolled students at the University of Minnesota who participate in Section activities. Twin City last year had a full schedule of nine meetings with an average attendance of almost 100.

Rambling Through Sect

JOINT meeting in Toledo, April 1 of **DETROIT SECTION'S** Toledo Division and Toledo Technical Council, with which Detroit Section is affiliated, was attended by more than 800 engineers and industrialists, who heard James Mooney, chairman and president of Willy's-Overland Motors, Inc., attack over-emphasis on style engineering and high-pressure distribution methods which have accompanied it. Talking on "Economic Forces and their Effect on the Automotive Industry," Mr. Mooney

Shown at SAE dinner in Toledo, April 1, are D. G. Roos, Willys-Overland Motors, Inc., R. P. Lewis, Spicer Mfg. Corp., and James D. Mooney, president of Willys.

branded the used car problem as the automobile industry's own creation and a result of manufacturers' overemphasis on style changes as opposed to engineering improvement. The public has shown clearly that it considers the automobile too useful and important to be purchased merely on the basis of appearance changes, Mr. Mooney declared.

"The automotive industry," he stated, "is at the end of one era in its development, and at the threshold of another." Engineering principles, he said, were, for a time, temporarily sidetracked. Strangely enough, the war has served to help automobile production to return to the normal, logical basis which characterized its early development.

In the early days of the industry, the fundamental need for transportation of goods and people was sufficiently strong to permit expansion in a market that created itself. Engineering talent was relentlessly applied to making the automobile mechanically fit for its task. Important words in those days were usefulness, durability, efficiency, and performance.

As the automobile changed from an item of luxury to a universal necessity, however, engineering considerations became less and less important; opportunism replaced practicality, and the yearly model change came into being. Result, Mr. Mooney pointed out, was a more costly, less efficient, less valuable machine.

Strict economics rose once more to the top with wartime rationing and the growth of transportation needs. Stabilization and progress began again to receive their rightful attention from the automotive industry.

Tampering with economic forces, in Mr. Mooney's opinion, has been one of the underlying causes of the so-called "problems" with which automotives has been faced in recent years. The industry, he said, had "bought volume at the expense of true economic progress" . . . and created for itself the troublesome used car problem.

Increased taxes, inflation, high costs and high price levels, he said, mean less money for automobiles, and will force the industry to think more in terms of utility and economy, less in terms of style.

At Willys, he reported, engineering always comes first . . . fashion second. There is no excuse, he feels, for compromise between engineering and styling. Logic based on an appraisal of trends in the industry dictates that functional fitness is the prime factor in any automotive product.

R. P. Lewis, chief engineer, Railway and Axle Division, Spicer Mfg. Co., extended a general welcome and introduced C. C. Eeles, president of the Toledo Technical Council, who outlined the purpose of the Council and paid tribute to its affiliated societies.

Toastmaster D. G. Roos, SAE past-president, and vice-president in charge of engineering of Willys-Overland Motors, Inc., introducing Mr. Mooney, pointed out the rapidity of the growth of the automobile industry from a "mere seedling" to the second largest industry in America. He attributed this early growth to favor-

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able economic, political and geographical conditions, to low taxes, to a favorable Governmental attitude, and to the huge available resources of fuel and oil.

Describing the work already accomplished and that still ahead of the SAE Technical Board, President Buckendale said that "Prosperity is geared to productivity and always will be. Productivity is the result of intelligent cooperation. The growth of SAE Technical activity is a sign of the appreciation of the fruits of cooperative endeavor."

A productive and prosperous society, he said, requires constant intelligent and energetic cooperation in human relations. The creation of the Technical Board has meant a complete reorientation of all phases of technical committee activity. He believes the numerous and varied problems which face and will face the Society can be solved by this pooling of our best technical talent. The complete interrelationship which exists among parts of the automotive industry, he said, "points to the important role of the SAE as the one place where an exchange of technical thought can be made to the cooperative benefit of all."

Aircraft Accessories meeting of **SOUTHERN CALIFORNIA SECTION**, March 8, featured papers by Edward W. Anger, Jr., of Lockheed Aircraft Corp., and John J. Draney, thermodynamicist for Consolidated Vultee Aircraft Corp.

Mr. Anger outlined the difficulties encountered by the aircraft manufacturers in purchasing and using accessory equipment produced by independent manufacturers. More control of accessory equipment is necessary, in his opinion, if efficient design and production of aircraft is to take place. Some advantage has been gained, he said, since the end of the war has brought a change from a seller's to a buyer's market. During discussion, representatives of accessory manufacturers reported that it was almost impossible to build an accessory satisfactory to more than one manufacturer. Mr. Anger pointed out that there are no standards by which accessories can be judged, so that independent tests must be made by manufacturers. Catalogs should include not hazy propaganda, he said, but concrete data on performance, installation, operating conditions, exact specifications, weight, environmental resistance, and noise suppression.

Mr. Draney discussed methods of heat recovery as applied to heating and anti-icing aircraft, including means of changing exhaust heat into usable heat for anti-icing. He gave detailed limitations of the current equipment, and explained the formulas necessary for calculating new design.

On March 1, **NORTHERN CALIFORNIA SECTION** held a special Central Valley spring meeting at Sacramento. Papers were "Bearings of the Future," by R. A. Watson, Federal Mogul Corp., and "Aviation Engine Lubricating Oil," by B. M. Berry and F. S. Rollins, California Research Corp.

Mr. Watson stated that either the steel-backed or all tin aluminum bearing is superior to copper lead and silver bearings on the basis of corrosion resistance, load carrying ability, imbedability and wipeability. His investigations have shown, he said, that aluminum bearings are not corroded by any heavy duty oil and will not scuff or score readily. In addition, closer tolerances can be attained with the aluminum bearing.

Mr. Berry pointed out that the upward trend in aviation engine output has been made possible because of several specific improvements: better structural material with regard to strength, weight and hardness . . . better application of structural materials . . . improved design of cylinder cooling, fuel and lubricating oil systems . . . development of fuels of improved volatility and octane number, which have permitted increased thermal efficiency and increased supercharging with consequent increases in specific output.

Discussing improvement of oil quality by up-rating the quality of mineral oils and by using special compounding materials which improve the oxidation resistance, detergency and wear reducing properties of the base oil, he reported that future refining improvements in mineral oil probably are limited, but that the field of detergent types of compounded oil is new and offers great possibilities. He described various methods used to evaluate aviation engine lubricating oils. Preliminary tests can be made, he said, in a relatively small bore Wisconsin engine which requires only small samples of oil. Promising oils are then proven in a full-scale single-cyl aircraft test engine. Mr. Berry concluded by reporting that the necessity for improving the mechanical features of aviation engines to provide more reliable operation, longer overhaul periods, and lower operating costs does not now require much emphasis, since these performance factors can be improved by bettering lubricant quality. Mechanical design of the engine must, of course, be such as not to limit possible improvements in performance. He believes the greatest improvement will be obtained in the future by the use of chemical additives which enhance the qualities of even those oils with the best natural characteristics.

New developments, current problems and past performances of railroad diesels, buses, and trucks were discussed during a question-and-answer type T&M forum at **NORTHERN CALIFORNIA SECTION**, March 12. Unusually high availability, better starting and acceleration, and low maintenance were reported by John Ronan, Southern Pacific Co., as the chief advantages of diesel engines in switching

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News from Hawaii

CHANGE in name of Hawaiian Section to "Hawaii Section" has been approved by the Council. Also authorized was the addition to Hawaii Section officers of a vice-chairman for aeronautics.

The Section will appoint a regional vice-chairman to represent the Island of Hawaii, and may create additional vice-chairmanships for the Islands of Maui, Kauai and Molokai.

At the suggestion of R. F. Steeneck, chairman of the National Sections Committee, the Council has sent a message to Hawaii Section expressing concern for the safety of Section members as a result of the disastrous tidal wave which swept the Islands early in April. "The Council extends sincere sympathy," the message read, "to any members of Hawaii Section who have suffered injuries or losses.

"We sincerely hope that all of you escaped without casualty of any sort."

Errata

IN his comments at the Vehicle Retirement Symposium, E. W. Templin was reported in the February issue to have said: "Entering a short term retirement plan cost my organization about a quarter of a million dollars. Normal retirement was interrupted by the war but the plan was well started."

To this should have been added Mr. Templin's statement that: "the investment of this money was part of a plan which saves the department between **$30,000** and $60,000 per year."

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Realistic Spark Plug Standards Under Way

URGENT need for revision and increased scope of present spark plug standards in both the aeronautical and ground vehicle industries has accelerated the activities of the SAE Electrical Equipment and SAE Aeronautics committees toward achievement of national and if possible international standardization of dimensions essential to interchangeability.

Pressed by military requirements for aircraft plug standardization, the aeronautics committee on screw threads has, as a result of an intensive effort, reached final agreement on a revised thread standard for the 18 mm spark plug as well as new standards for the 14 mm, 12 mm, and 10 mm plug sizes, which have come into general usage. The ground vehicle electrical equipment committee, having completed the work of more exigent wartime demands, is rapidly setting about the task of revising the existing ⅞ in. and 18 mm general automotive plug standards and adopting standards for the 14 mm, 12 mm, 10 mm and perhaps 8 mm sizes.

Standards Value Cited

The economic value of spark plug standardization is more fully realized by examining the difficulties giving rise to its need. Lack of an adequate spark plug thread standard has proved to be a problem to the over 20 producers, engine manufacturers and vehicle and aircraft operators. An added feature of particular importance to the general automotive field requiring standardization is plug terminal dimensions.

Tracing the lack of uniformity in plug threads to its source, it is revealed that the tapped holes in both automotive and aircraft cylinder heads were originally kept basic. However, for any given size, the thread dimensions of a tapped hole will vary as to cylinder head material and fit desired, because cylinder material such as cast iron, aluminum and copper differ in their coefficient of expansion and machining characteristics. As a result, plug thread dimensions originally had to be tailored to almost each type of engine with a varying degree of interchangeability in each plug size. Therefore, contrary to accepted practice of establishing a basic hole size and varying the mating part to obtain the desired fit, the plug thread – especially in the aeronautical field – was made basic and the tapped hole varied to satisfy the variable factors.

Variety Reduced

Incorporation of this philosophy in recent years in spark plug standards has been instrumental in reducing the great variety of plugs in each size and has rendered valuable service in simplifying the job at the producer and especially the user level. Spark plug manufacturers are relieved of high tooling costs and production nuisances and operator maintenance is aided by less complex plug selection.

Following the above concept, the new aeronautical spark plug standard now in process of final approval establishes basic dimensions and tolerances for the major, minor and pitch diameters of the 18 mm, 14 mm, 12 mm, and 10 mm plug sizes and also provides a recommendation for required tapped hole dimensions. In addition, ring and plug gage dimensions are given. It is noteworthy that committee cooperation with the British Ministry of Aircraft Production has led to virtually complete agreement between British and American standards – an obvious benefit to expanding transoceanic airways.

However, in addition to the need for revised automotive plug thread standards, dissimilarity of ground vehicle plug terminals further complicates maintenance problems as differences in terminal shapes and dimensions peculiar to each manufacturer make for an equal number of variations in harness cable leads to the plug terminals. Both spark plug and ignition accessory producers have long seen the need for a plug terminal standard and are now ready to assist the committees in this direction. Standardizing terminals does not constitute a serious problem in aircraft plugs as the attaching parts are standardized.

As the art improves, it is expected SAE committees on spark plug standards will, as they have done for over 30 years, continue to keep pace with new practices, modernizing spark plug standards in accordance with the demands of both producer and user, with the desirability and advantages of international standardization in mind. The standardization of general automotive plugs has been assigned to a special subcommittee of the electrical equipment committee of which R. M. Critchfield of Delco-Remy Division, General Motors Corp., is chairman.

The members of the aeronautical screw threads committee, which developed the new aircraft plug thread standard, are Chairman G. Carvelli, Wright Aeronautical Corp.; G. L. McCain, Chrysler Corp.; C. J. Dowell, Allison Division, General Motors Corp.; R. G. Anderson, Aluminum Co. of America, and J. G. Perrin, Pratt & Whitney Aircraft, Division of United Aircraft Corp. Formerly known as Committee E-6, it is now being reorganized under the new SAE Aeronautics Division committee structure and has been designated Committee E-26.

Represented Buckendale At Minnesota Inaugural

DEWEY E. HULT, chairman of the SAE Twin City Group, represented SAE President L. Ray Buckendale at the inauguration of James Lewis Morrill as president of the University of Minnesota April 23-25 at Minneapolis.

Dewey E. Hult

Common Crankcase Oil Nomenclature Suggested

IN the transition to the postwar period, it is urgent that a suitable common nomenclature be provided for the several types of engine crankcase oil that will be available generally to private and commercial vehicle operators at filling stations and dealers service departments. The Lubricants Committee of the Society of Automotive Engineers, Inc., submits the following as furnishing such a nomenclature.

Crankcase Oils

Up to 1945 automotive crankcase oils were classified in terms of viscosity only, other factors of oil quality or character not being considered. By that time developments in refining methods and treatments had led to an increased variety of oils which the Lubrication Committee, Division of Marketing of the American Petroleum Institute has classified as follows:

"Regular Motor Oil – This term shall be used to designate a straight mineral oil. Oils of this type are generally suitable for use in internal combustion engines under moderate operating conditions."

"Premium Motor Oil – This term shall be used to designate an oil having proved oxidation stability and bearing corrosion preventive properties. Oils of this type are generally suitable

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Blanchard Appointed to Guggenheim Board

W. J. BLANCHARD, Aeroproducts Division, General Motors Corp., has been appointed by President Buckendale to serve as SAE representative on the Daniel Guggenheim Medal Board of Award. Mr. Blanchard's term will begin Oct. 1, 1946. Present SAE representatives on the Board are Past-President Mac Short, Lockheed Aircraft Corp., G. A. Page, Jr., Curtiss-Wright Corp., and R. D. Kelly, United Air Lines.

W. J. Blanchard

for use in internal combustion engines where operating conditions are such that regular oils do not give satisfactory service."

"Heavy-Duty Motor Oil – This term shall designate an oil having proved oxidation stability, bearing corrosion preventive properties, and detergent-dispersant characteristics. Oils of this type are generally suitable for use in both high speed diesel and gasoline engines under heavy-duty service conditions."

Moderate or Average Conditions

For many years passenger car and truck engines have been lubricated with refined straight mineral oils which have been classified by the American Petroleum Institute as regular motor oils. The majority of gasoline engines in use today, particularly in passenger cars, when operated under ordinary driving conditions can continue to be serviced with such oils as satisfactorily as in the past.

More Severe Conditions

As ordinarily used, the engine of a passenger car is seldom called upon to develop its full power. If, however, the same engine is used in a different type of service, as in mountain climbing, fast acceleration or sustained high-speed driving, or is installed in a light truck, bus, tractor, motor boat or industrial equipment, it may have to operate at full power or more nearly full power for a much larger percentage of the time. Under these conditions the temperature of practically all operating parts of the engine will be higher than in the same engine when used under moderate or average driving conditions. Excessive heating is harmful to all lubricating oils. Hot oil will combine with oxygen, forming oxidation products which will contaminate the oil and may form harmful deposits on vital engine parts. Oils having improved stability and oxidation resistance may accordingly be required under these conditions. The American Petroleum Institute has classified oils of this type as premium motor oils.

Heavy Duty Conditions

In many heavy-duty operations, such as prevail in sustained high speed travel under heavy loads in some truck and bus service, the oil must possess detergent qualities in addition to improved oxidation resistance. Oils of this type, which have proved oxidation stability, bearing corrosion resisting properties and detergent-dispersant characteristics, are classified by the American Petroleum Institute as heavy-duty motor oils. Oils that meet the engine test requirements of U. S. Army Specification 2-104B or the U. S. Navy 9000 series are classified as heavy-duty motor oils. These oils are recommended for high-speed diesel engines and for gasoline engines in heavy-duty bus, truck, tractor, marine or industrial service.

Relating Factors

Satisfactory performance of engines in service is dependent upon four factors:

1. Operating conditions and maintenance
2. Engine design
3. Fuel
4. Lubricating Oil

Although the crankcase oil is an important factor in engine performance, each of the other items is also vitally important.

The above paragraphs have been written to assist in the selection of the most suitable lubricating oil for the different operating conditions. Satisfactory engine performance requires the utmost care in proper selection of the oil and continual attention to the other factors.

Packaging

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of each type of engine part, recommending the use of materials specified in the above-mentioned specifications and standards.

A typical procedure outlined in this recommended practice covered the complete accessory drive assembly as shown in the accompanying illustration. The accessory drive assembly, (1), is given a preliminary cleaning using a petroleum solvent to wash dirt from the part. The unit is then coated with a preservative corrosion-preventive compound consisting of lubricating oil and corrosion inhibitor. Bags of silica gel, (2), are inserted in the package as a dehydrating agent. Items (3) and (4) are a corrugated fiberboard insert and sleeve respectively. A humidity indicator card, (5), will reveal the internal condition of the package immediately upon opening. The moisture-vapor barrier, (6), consisting of a heat-sealed, laminated foil, envelopes the inner boxing and provides a moisture-proof covering. The outer fiberboard container, (7), serves as an exterior boxing and protects the barrier bag. This container was considered adequate for domestic shipping.

The third phase of the problem of interest to the new committee involves preservation and packaging of accessories and equipment. This work was originally undertaken by the SAE at the urgent request of the military services to standardize the procedure for all accessory manufacturers and to establish a guide for all branches of the service. A total of 15 subcommittees under Committee A-13, Preservation and Packaging of Aeronautical Equipment, were set up to concentrate on such items as magnetos, carburetors, propellers and instruments and an all-inclusive master packing list was prepared within several months. The master list recommended one of four standard methods of preservation and packaging for the various components under each accessory category.

The first method covered parts which are already corrosive-resistant such as painted, anodized and impregnated surfaces. All that was necessary in this case was commercial packaging to prevent physical damage.

The second method applied to non-precision parts subject to corrosion such as keys, pins and hardware. Proper cleaning, rinsing and preservation were prescribed in addition to an outer wrapping of grease-proof, acid-free paper and an exterior packaging.

The third method was recommended for highly finished, critical surfaces such as those on shafts, bearings and gears. In addition to cleaning and preserving, these parts required a waterproof container of either a laminated foil bag or a wax-dipped, non-corrosive paper wrapping.

The fourth method dealt with parts such as turrets, electric meters, and radio transmitters which, because of their construction, could not be protected by the above methods. It was stipulated that all exposed finished surfaces be covered with paper prior to insertion into the pliofilm or foil barrier bag and that silica gel bags be placed in the barrier.

It is the engine spare parts recommended practice and the accessory master packing list that Committee S-6A will modernize and consolidate in a single volume which will serve as a central source of preservation and packaging information for the aeronautical industry.

Accomplishments of the old committees have been evaluated by Rear-Admiral E. D. Foster, of the Philadelphia Aviation Supply Depot as "a very definite and essential contribution to the successful culmination of the war."

A. P. Ayres, Jr., chairman of old Committee E-9 and P. J. Kondla, chairman of old Committee E-9A, have accepted the chairmanship of Committee S-6 and Subcommittee S-6A respectively and are now in the process of completing selection of committee members.

Frudden Takes Rosen's Post on CRC Board

C. E. FRUDDEN, consulting engineer of the Tractor Division, Allis-Chalmers Mfg. Co., Milwaukee, has been appointed a member of the Board of Directors of the Coordinating Research Council, succeeding C. G. A. Rosen, resigned.

A member of the Society for more than 20 years, Mr. Frudden in January, 1946, began a two-year term as a member of the SAE Council. Previously he had served as SAE vice-president representing Tractor & Industrial Power Equipment Engineering in 1938. He has been active in the Milwaukee Section for many years, and has served as Section treasurer, vice-chairman, and chairman. He has been a member of numerous technical committees of the Society.

C. E. Frudden

He took his degree in mechanical engineering at Iowa State College, and studied at Columbia University. He began his engineering career at Hart Parr Co., now Oliver Corp., and was an engineer for Parrett Tractor Co., and the Buda Co., prior to World War I when he was commissioned a captain in the Army's Motor Transport Service.

During 1942 and 1943, he was a consultant to WPB's Farm Machinery & Equipment Branch, after which he returned to his present post with Allis-Chalmers.

Use of Heavy-Duty Oils Questioned For Average Passenger Car Service

Digest of paper

by LYLE E. CALKINS

Willys-Overland Motors, Inc.

■ F & L Meeting, Nov. 6

(Paper entitled "Some Performance Characteristics of Detergent Motor Oils Versus Non-Detergent Motor Oils")

INCREASED oil consumption, reduced filter efficiency, with no reduction in sludge formation or engine wear – these are the results to be expected from the use of heavy-duty oil by the average passenger-car owner, according to Mr. Calkins, who bases his conclusions on a series of dynamometer tests carried out to compare the effectiveness of heavy-duty oil with a good grade of oxidation and bearing corrosion inhibited mineral oil – so-called premium oil.

The test program was formulated because the successful use by the armed forces of heavy-duty oil conforming to U. S. Army Specification 2-104-B indicated that such oils might be necessary or desirable in general passenger-car service.

Test Procedure

The oils used in the tests were made from the same crude stock and contained the same neutrals in varying proportions. The heavy-duty oil contained a detergent additive, met the requirements of 2-104-B, and passed CRC L-1 test. The premium oil did not contain a detergent additive, but it was inhibited for oxidation and bearing corrosion. It passed CRC L-4 and L-5 tests. Both oils were SAE 30 grade.

The analysis of the oils before the tests is given in Table 1.

The fuels were: (1) high lead fuel containing 3.00-3.65 cc tel per gal and having 80 ASTM octane rating; and (2) low lead fuel containing not over 0.36 cc tel per gal and having a 70 ASTM octane rating. Two engines, built of standard production parts, were run in for 16 hr. All test runs were made at 3200 rpm, which is equivalent to 56.2 mph road speed, and at road load, namely 23.8 hp. Runs 1 through 5 were 18 hr each, or 1012 miles under these conditions. Run 5 was made under conditions identical to Run 1, as a check on Run 1 of both engines. Run 6 was a flushing operation. Run 7 was made because at the end of five runs the oil consumption of each engine was reasonably equivalent. The engines were run at 3200 rpm for 89 hr under road load, equivalent to 5000 miles.

Crankcase temperature was maintained at 190-200 F during the tests.

At the end of each run the oil consumption was calculated from the weight of oil drained from the crankcase. The oil and the filter cartridge were then analyzed for oil and sludge data. After that, the engine was filled with the oil to be used in the next run for the purpose of flushing. It was run at the stated conditions until the oil in the crankcase reached 180 F. The oil was drained while hot for at least 20 min before new oil for the next run was added. At this point a new oil filter cartridge was installed. Fuel changes were made during the flushing operation.

Data on oil consumption are given in Table 2.

The results of Run 7 show a significant difference in oil consumption. Engine 1, using heavy-duty oil, showed a sharp increase in oil consumption, which amounted to 33%; this represents a decrease of 952 mpg. On the other hand, Engine 2, using premium oil, showed only a 2% increase in oil consumption, a decrease of 50 mpg.

Table 3 shows the average oil consumption for the two types of oil on both engines.

Sludging Characteristics

The type of filter used in the tests was well suited to the study of deposits in filters, for it could be taken apart with a can opener and thoroughly cleaned, piece by piece. Each layer of the filter was brushed in naphtha until clean. The naphtha containing the residue on the filter was centrifuged to separate the sludge. After washing with naphtha, the residue was dried and weighed. The engine oil was diluted with naphtha and centrifuged to collect the sludge. In this manner the author was able to determine the sludge in the oil, that retained by the filter, and the total sludge in both. The efficiency of the filter was calculated in terms of per cent of sludge retained on the filter. These data are given in Table 2.

A study of the results shows that, when both oils were used with low lead fuels, the average amount of sludge formed (calculated on total sludge) was in the ratio of 1 to 2.2, the greater amount being formed with the heavy-duty oil. When high lead fuels were used the ratio was 1 to 0.82, more sludge being formed with premium oil. By taking into account the efficiency of the filter, the amount of sludge circulating through the engine presents a different picture. The ratio for sludge circulating in the oil is 1 to 6.25 with low lead fuel and 1 to 2.75 with high lead fuel. The larger figure represents the runs using heavy-duty oil. The difference in ratios indicates that filter efficiency increases when using heavy-duty oil with high lead fuel. Filter efficiencies in two runs using heavy-duty oil and high lead fuel are 67.9 and 36.7% for Engines 1 and 2, respectively. Engine 1 produced 11.97 g of sludge, while Engine 2 produced 6.505 g; yet the amount retained on the filter is about the same in each engine, namely 4.4 g. Perhaps the heavy-duty oil will not allow more sludge to be retained on the filter until the concentration of sludge in the oil increases beyond that in Engine 1.

The average amount of sludge retained on the filter for all runs was 82.6% for the premium oil and 44.5% for the heavy-duty oil.

The results of Run 7 indicate that the use of heavy-duty oil increased oil consumption, although this is inconclusive, the author warned, because it is the result of only one test and should be rechecked several times. The author reported, however, that he did not have sufficient time to make

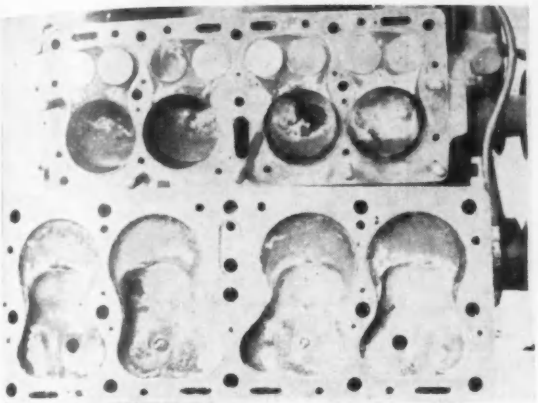
Table 1 – Oils Used in Test Runs

	Premium Oil	Heavy-Duty Oil
Gravity, deg API	29.3	28.8
Flash, C.O.C., F (min)	415	400
Fire, C.O.C., F (min)	500	515
Viscosity at 100 F, SUS	479	419
Viscosity at 130 F, SUS	222	192.6
Viscosity at 210 F, SUS	64	59.6
V.I., ASTM	104	101
Color, N.P.A. (max)	6	5
Conrad Carbon Residue, %	0.38	0.52
Sulfated Ash, %	0.15	0.36
Neutralization No.	0.22	0.90

Table 2 – Test Results

	Fuel and Oil	Oil Used, lb	Oil Consumption,[a] mpg	Total Amount of Sludge, g	Sludge in Oil, g	Sludge Retained on Filter, g	Sludge Retained on Filter, %
Engine 1							
Run 1 1000 Miles	High lead Premium	1.79	4172	12.509	1.32	11.189	89.4
Run 2 1000 Miles	High lead Heavy duty	2.04	3661	11.970	7.57	4.40	36.7
Run 3 1000 Miles	Low lead Premium	2.36	3165	0.440	0.025	0.415	94.3
Run 4 1000 Miles	Low lead Heavy duty	2.88	2593	1.181	0.832	0.349	29.5
Run 5 1000 Miles	High lead Premium	2.58	2895	14.207	1.249	12.958	91.2
Run 7[b] 5000 Miles	Low lead Heavy duty	18.98	1943	10.93	8.9	....	....
Engine 2							
Run 1 1000 Miles	Low lead Premium	2.22	3384	0.277	0.072	0.205	74.0
Run 2 1000 Miles	Low lead Heavy duty	2.42	3086	0.540	0.303	0.237	43.9
Run 3 1000 Miles	High lead Premium	2.07	3608	7.235	1.135	6.10	84.3
Run 4 1000 Miles	High lead Heavy duty	2.18	3425	6.505	2.081	4.424	67.9
Run 5 1000 Miles	Low lead Premium	2.84	2630	0.502	0.189	0.313	62.4
Run 7[b] 5000 Miles	Low lead Premium	14.30	2580	6.30	3.06	....	....

[a] All oil consumption figured at 7.38 lb per gal of oil.
[b] No oil filter used.



■ Fig. 1 – Cylinder head and block of Engine 1 after Run 7 using heavy-duty oil

such check runs before the presentation of the paper. He felt, nevertheless, that some comparison between the two types of oil could be made from the results of this run.

Using the same fuel, the engine with heavy-duty oil produced more sludge than that using premium oil. The heavy-duty oil carried 8.9 g of sludge in suspension as compared with 3.06 g in the premium oil, as shown by Table 2.

Table 3 – Oil Consumption on Engines 1 and 2 – Average for Premium and Heavy-Duty Oil

	Mpg
Average Oil Consumption for Engines 1 and 2 for 9000 Miles Using Heavy-Duty Oil	2318
Average Oil Consumption for Engines 1 and 2 for 11,000 Miles Using Premium Oil	2885

The difference is 567 mpg in favor of the premium oil, r 24.5% more mpg of oil with premium oil.

There was no significant difference in the wear or cleanliness of either engine. Figs. 1 and 2 illustrate this point for the cylinder head and block of each engine after Run 7.

Mr. Calkins was not able to include results from road and duplicate dynamometer tests in his paper, as this part of his testing program had not yet been completed; his tentative conclusion, however, based on results to date, was that heavy-duty oils are not superior to premium oils for average passenger-car service.

DISCUSSION

CHALLENGING this conclusion, the discussers of the paper dissected thoroughly both the materials and the test procedure used by Mr. Calkins. They noted, for instance, that the viscosity and the viscosity index of the heavy-duty oil were slightly less than those of the premium oil, and suggested this fact might possibly have caused the somewhat greater oil consumption that occurred when the heavy-duty oil was used.

Several of them also pointed out that oil consumption increased greatly during the course of the tests, indicating that if the heavy-duty oil had been tested before the premium, the tables would have been turned and less heavy-duty oil would have been consumed than premium oil.

In discussing this point, J. W. Lane, Socony-Vacuum Oil Co., Inc., explained that there was no appreciable difference in oil consumption throughout a 5000-mile test run made in his laboratory, although there was a little difference in oil consumption between the detergent and the nondetergent oil, and the tendency was for the detergent oil to be consumed somewhat less rapidly as the test continued.

The characteristic of heavy-duty oil in retaining solids in suspension rather than allowing them to be retained by the filter is meritorious and not a disadvantage as Mr. Calkins concluded, according to some of the discussers. One of the purposes of heavy-duty oil, Mr. Lane said, is to retard coalescence of the carbonaceous contaminants, thus rendering them capable of being suspended harmlessly in the oil so that they can be drained with the oil each time it is changed, rather than tending to deposit on the engine interior. In any case, Mr. Lane said, the oils reported by Mr. Calkins were so clean that the difference is not significant.

Oils of the heavy-duty type can be classified as nonvisually filterable or visually filterable, according to Earl Gunn, Fram Corp., who said that all heavy-duty oils so far tested in his laboratory fall into the nonvisually filterable class when new. A large percentage of them, however, change to visually filterable oils in less than 300 miles of normal city driving, and from then on, he stated, any good filter will keep them clean. Unfortunately, he pointed out, there is no way at present for the buyer to know which type he is getting. Even with the 2-104-B oils that do become visually filterable, it appears that some types of otherwise desirable filters are unsuitable because they become coated with material so fine as to retard greatly the passage of oil, thus seriously reducing filter efficiency. No such problems can occur, Mr. Gunn said, with the premium oils used by Mr. Calkins. In fact, he continued, the phosphorus-type oxidation inhibitors are themselves powerful coagulants, and when a small amount is placed in otherwise unfilterable turbid detergent oil, filtering becomes easy.

H. R. Wolf, Research Laboratories Division, General Motors Corp., suggested that the crankcase oil temperature used by Mr. Calkins was too low to bring out differences in oxidation stability; and that, in general, the tests were conducted under operating conditions that do not show differences in detergent characteristics, consequently, there would not be a significant difference in the cleanliness of either engine at the end of the tests. Due to mechanical differences in the two engines, Mr. Wolf pointed out further, the five tests on heavy-duty oils and the seven tests on premium oils should not be averaged for the two engines, as was done in Table 3.

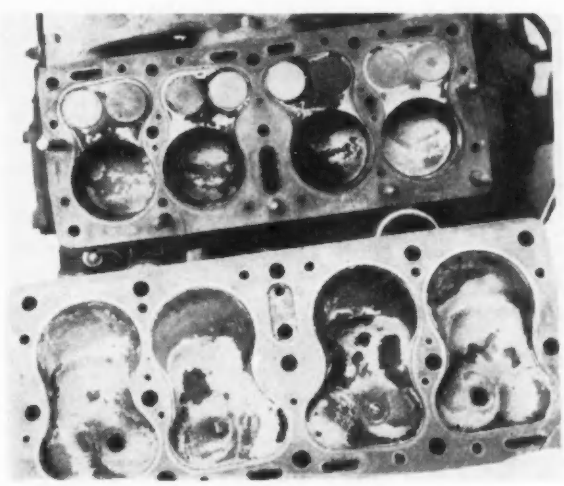
Detergency, Mr. Wolf said, is of little or no importance in average passenger-car gasoline-engine service, such as represented by the dynamometer test made by Mr. Calkins. It is rather in severe passenger-car service and in gasoline truck and bus service that detergent compounds are of importance, he concluded.

F. C. Burk, Atlantic Refining Co., described some tests run first on an engine with badly plugged oil control rings and then after the rings had been cleaned. Cleaning the rings decreased oil consumption from 1.55 lb per hr to 0.25, thus illustrating, he said, the importance of using detergent oils to keep oil rings clean.

The cleaning effect of detergent oils was confirmed by Mr. Lane, who reported that when a fleet of passenger cars that had been using other types of oils was changed over to heavy-duty oils for 2000 miles, there was a definite cleansing action noticeable.

In a series of 10,000-mile road tests on passenger cars, Mr. Burk also reported that the average per cent varnish and sludge ratings were appreciably higher for the detergent oil. Cylinder and piston wear was well within the limit of error for the test, so that wear differences were considered negligible. Oil consumption differences, similarly, were so slight as to be within the limit of error.

■ Fig. 2 – Cylinder head and block of Engine 2 after Run 7 using premium oil



Luxury Plane Previewed

Digest of talk

by R. L. LOVERIDGE

Boeing Aircraft Co.

■ Northwest, Feb. 1

(Summary of ideas expressed by Mr. Loveridge in his talk entitled "Tomorrow's Airplane Today")

OVER two million design manhours, many of them recorded by the more than 50 SAE members employed at Boeing, have

Boeing Stratocruiser

gone into the Stratocruiser whose high speed, long range and high altitude characteristics make possible unbelievable transworld schedules.

Although an outgrowth of the B-29, with similar wings, tail surfaces and landing gear, the Stratocruiser is 12 ft longer, has twice the fuselage volume of the Superfortress, and has a tail 5 ft higher. It weighs 67½ tons, and can fly a larger, faster payload than any transport in present operation, and a larger percentage of its gross weight becomes useful load.

Improved pressurization provides flying conditions in the stratosphere, high above surface storms, with great comfort. At altitudes up to 15,000 ft, sea level conditions will be possible.

The Stratocruiser will be equipped with four 3500 hp Pratt and Whitney Wasp engines. Three engines can sustain flight at 20,000 ft. Reverse thrust propellers, used in landing as an auxiliary brake, permit gentle landings in shorter distances.

Concerted efforts were devoted to reduction of the plane's time on the ground. Cargo doors of man height, electric hoists for the all-cargo ship, and simplified maintenance through easier access to electrical equipment are already perfected means for reducing indirect operating costs.

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Future Truck Trends Emerge Despite Conflicting Demands

Digest of Paper

by MERRILL C. HORINE

Mack Mfg. Corp.

■ Virginia, Aug. 23

■ Chicago, Nov. 14

■ Cincinnati, Dec. 13

(Digest of papers discussing future truck design)

EVOLUTION, not revolution, will shape the postwar truck, in Mr. Horine's opinion. Revolution is the forte of the enthusiastic popular writer, he said; the engineer's problem is the gradual bettering of truck design, with an effort along the way to gather in the diverse threads of demands by owners, mechanics, drivers and parts designers.

Speed, safety, economy and capacity are of prime importance to the truck owner; the mechanic places accessibility at the top of the list, and the driver wants above all comfort, ease of control, and visibility.

In addition, Mr. Horine said, the designer's dilemma is complicated by the industrial designer's fascination with smooth impracticable convexity; tire and rim manufacturer's demand for bigger, wider rims and tires; legislative restrictions on total length; highway engineer's requirement of maximum wheelbase for safe load distribution on bridges; and safety requirements of shorter stopping distances and a miscellany of gadgets. Some of these are incompatible; others are only difficult.

Apart from the mechanical problem of designing to meet specifications, he added, considerable confusion is likely to arise in the superficially simple matter of finding out what is wanted and translating it into reasonable engineering format. While the specifier normally will do his thinking and make his requests in terms of things, he said, the designer must apply principles as a means of arriving at desired results; lack of a common language makes for muddied communication between, for instance, drivers and designers; and the subjective demands of owners and users for particular mechanisms which they believe beneficial must be generalized into objectives that will then be met in the best way feasible.

An extra variable in the already complex formula, he pointed out, is the time element . . . new designs cannot be conceived and produced instantaneously. While experiments are going on there will be new developments and competition from other manufacturers, so that frequent modifications of the emerging design will be necessary.

Predictions

For the next few years, he believes, most trucks will keep engines under the hood in front, and the remainder will have the cab over the engine. He expects the "overgrown pleasure car" style to disappear. When regular gasoline grades pass 85 octane, overhead valve engines may replace L-head engines to a considerable extent. However, he predicts a disappointing outcome of promising aviation fuel accomplishments in so far as their ground application is concerned, since it probably will be at least a decade before 100 octane gasoline is available for trucks and buses, and existing engines are incapable of deriving any benefit from it.

Innovations such as alligator hoods, lamps sunk into fenders and higher catwalks between fenders and hood may appear, but with powerplant accessibility given prime attention.

Cooling systems have benefited greatly from war experience, he said, and in future even more emphasis will be placed on close maintenance of overall cooling water temperature and of uniform engine temperature.

Diesel engines will keep their place as movers of long distance, heavy tonnage because of their large fuel economies over a period of time.

Other aspects of truck design which he believes should and will receive much consideration are automatic transmissions, oil temperatures, higher horsepower per gross weight, better brakes of more varied types, and improved suspension systems. There will probably be higher spring mounting for better stability and easier riding.

Revised Thinking

Interesting recent "discoveries" in the field of powerplant design are that greater power for the same gvw means less, not more fuel consumption . . . transmission and rear axle size need not be increased in proportion to engine torque output, where gross weight remains the same . . . often a large engine reduces wear and maintenance on units of identical size.

Simple explanation, he said, lies in the fact that maximum engine economy is secured only at open throttle, so that the throttle is the greatest enemy of economy. Smaller engines require more gear reduction to pull the load, and must turn at higher rpm to develop required power, and thus will be less economical. Large-displacement engines in connection with fast total ratios reach maximum road speeds at engine speeds below the governor setting, with full throttle, and, he reported, give very good results.

In addition, larger transmission, driveshaft, rear axle, frame, springs, front axle and brakes are not implied by a larger engine. Actual torque is limited by the tractive resistance of the vehicle, regardless of the engine's potential torque production. And torsional impact will be limited by the vehicle's mass inertia. For this reason the large engine can exert no more stress on driving parts through the same gear reductions than the small engine, and may exert less, with faster ratios.

Prerequisite for successful designing of the postwar truck, Mr. Horine emphasized, is an understanding of these fundamental principles, and, at the same time, careful survey of the wide fields of possible new materials, new methods, revised needs and changing cost conditions. Exhaustive experiment should prove, before ideas are solidified, that the projected product will meet performance specifications.

Definitions Evolved By Oil Committees

Digest of paper

by H. R. WOLF
General Motors Corp.

▪ Annual Meeting, Jan. 11

(*Paper entitled "Motor Oils – Regular, Premium and Heavy-Duty"*).

CRANKCASE oils of the straight mineral and the inhibited and detergent types have now been classified and defined, Mr. Wolf reported, as the result of cooperative efforts between the petroleum and automotive industries. Plans have been made to include this information eventually in the SAE Handbook.

The names and definitions chosen for these oils are:

1. Regular motor oil: This term shall be used to designate a straight mineral oil. Oils of this type are generally suitable for use in internal-combustion engines under moderate operating conditions.

2. Premium motor oil: This term shall be used to designate an oil having proved oxidation stability and bearing corrosion preventive properties. Oils of this type are generally suitable for use in internal-combustion engines where operating conditions are such that regular oils do not give satisfactory service.

3. Heavy-duty motor oil: This term shall designate an oil having proved oxidation stability, bearing corrosion preventive properties, and detergent-dispersant characteristics. Oils of this type are generally suitable for use in both high-speed diesel and gasoline engines under heavy-duty service conditions.

In the early years of the automobile industry, Mr. Wolf pointed out, no classification was available for recommending crankcase oils to the individual car or truck owner; each manufacturer published a list of recommended oils by trade names.

It was not until July, 1926, that the Lubricants Division of the SAE Standards Committee adopted the well-known classification for crankcase oils based on viscosity. Surprisingly enough, this classification is in effect today with only minor changes, except that in 1941 the classification was supplemented by two winter oils, 10W and 20W, with viscosities specified at 0 F to ensure easy starting.

The SAE viscosity numbers served well for a number of years to classify oils, when oil consumption and ease of starting at low temperatures, which are direct functions of viscosity, were the primary distinguishing differences between oils refined from different crudes and processed by different refinery methods.

By 1940, however, it began to be realized that straight mineral oils oxidize under the more severe service conditions and are unsatisfactory for use in high-speed, high-output engines, which, nevertheless, do operate satisfactorily with oils containing suitable additives. Before this period, the oil industry had generally insisted that all internal-combustion engines should be able to operate on straight mineral oils without the use of addition agents, and if lubrication difficulties were experienced, it was due to faulty engine design.

This realization led to the introduction by some refiners of oils containing additives, and known as premium oils.

Meanwhile, under the impetus of war, the Army, in conjunction with the petroleum industry, was developing a specification for heavy-duty oil, which eventually culminated in U. S. Army Specification 2-104-B.

Development of Nomenclature

The marketing of oils containing additives made the adoption of a widely recognized and used nomenclature for oils most desirable; for then it would be possible for the vehicle manufacturer to recommend a type of oil that the operator could easily identify and obtain.

In this connection, the use of the term "heavy duty" has been almost universal for the past six years to designate the kind of oils, containing both oxidation inhibitors and detergent-dispersant compounds, that are defined by U. S. Army Specification 2-104-B. Even in the Army it is referred to as "heavy-duty oil," although its official designation is "oil, engine, lubricating, all purpose for use in automotive gasoline and diesel engines."

The problem thus became one of selection of suitable terms to designate:

(a) The intermediate type of oil that is highly resistant to oxidation, but that possesses little or no detergent or dispersant characteristics.

(b) Straight mineral oil.

This problem was discussed by many technical groups during the latter part of 1944 and the early part of 1945 and, on May 15, 1945, the Coordinating Lubricants Panel of the CRC drew up a set of names to cover the motor oils now in use. The names chosen were: normal-duty oil, general service oil, and all-purpose oil.

A few days later these definitions were reviewed by the Automotive Engine Oil Section, Technical Committee B, ASTM D-2, which made slight revisions in the suggested definitions.

The next action came from a subcommittee of the Lubricants Division of the SAE Standards Committee, which made no change in the definitions but was strongly opposed to the suggested nomenclature, because it felt that the proposed names did not adequately describe the several types of commercially available crankcase oils, did not suitably distinguish between the different types, and did not clearly indicate the preferred applications.

After considerable discussion this group proposed the name "mineral engine oil" in place of normal-duty oil, "heavy-duty oil, Type I," in place of general service oil, and "heavy-duty oil, Type II," in place of all-purpose oil.

The technical committees participating in the program recognized that final approval should come from the marketing interests of the petroleum industry, for only if the nomenclature were widely used to identify oils would its full value be realized. These committees made their recommendations solely to stimulate discussion and to assist the marketers in reaching a commercial solution to the problem.

Accordingly, after participation by the Lubrication Committee, API Division of Marketing, the General Committee of that organization finally recommended the nomenclature and definitions already given.

A committee was then organized by the National Petroleum Association to suggest additional names, because of protests made to the proposed use of the term "premium." The objections were that this term should not be used to designate an intermediate oil, that it had been used to designate retail selling price, and should not now be used to designate quality. A meeting of this committee with the API Lubrication Committee, however, resulted in reaffirmation of the nomenclature already adopted by the API General Committee.

It can be seen from the definitions that they do not enumerate directly all the properties that are inherent in each of the several types of oils. During the development of the definitions, Mr. Wolf pointed out, every effort was made to avoid writing inspection limits into them, but, he stated, this omission is not to be construed as an invitation to reduce quality or to reclassify inferior products into a higher performance bracket.

Regular motor oil is defined as a straight mineral oil; however, since the definition states that "oils of this type are generally suitable for use in internal-combustion engines under moderate operating conditions," it is clear that only such straight mineral oils as can be used under the above stated conditions can be classified as regular motor oils.

Premium motor oil is defined as having proved oxidation stability and bearing corrosion preventive properties; this does not mean, however, that other properties are to be disregarded. The definition suggests that, in addition, these oils must possess all of the supplementary performance characteristics that may be required to ensure satisfactory operation under the more severe service conditions, where regular oils fail.

Similarly, heavy-duty oils are expected to have characteristics in addition to those specifically mentioned in the definition. In other words, they must possess oxidation stability, detergency-dispersancy characteristics, and other performance properties in the required degree to make them suitable for use in all types of internal-combustion engines under the most severe heavy-duty service conditions that these engines are capable of reaching. These requirements clearly indicate that the oils should meet at least the minimums imposed by 2-104-B.

In formulating the API definitions, Mr. Wolf explained, the groups involved felt that all properties pertaining to quality should remain the responsibility of the individual petroleum marketer and that no attempt should be made to incorporate minimum requirements or inspection limits for these qualities. It was further believed that these definitions should be limited to properties that characterize the several types of commercial crankcase oils and to clear-cut statements indicating the intended service application.

Note: Full text of the paper by Mr. Wolf, together with the extensive discussion that followed its presentation, will be available shortly from the SAE Special Publications Department, 29 West 39 St., New York City 18, for 25¢ to members, 50¢ to nonmembers.

Turbine Future Qualified By Uninvestigated Aspects

Digest of paper

by **C. RICHARD SODERBERG**

Massachusetts Institute of Technology

■ So. New England, Nov. 7

(*Paper entitled "The Gas Turbine"*)

THE fifth major development in prime movers in the last century and a half promises to reshape the future of this field, Prof. Soderberg declared. Out of the unsuccessful nineteenth century caloric engine, prodded by apparent limitations of the internal combustion engine, the modern gas turbine emerged logically as a means of driving the supercharger.

Early caloric engines, he pointed out, showed great promise because of their advanced application of the Carnot principle, but were hampered by the undeveloped state of mechanical engineering knowledge.

The present version of the gas turbine, he said, has certain advantages and certain disadvantages, which average up to a need for the introduction of newer, better turbine types.

Inlet flow to a representative turbine is about 30 times greater than to the steam turbine, exhaust flow about 1/3 as great, both favorable. There are, however, severe temperature limitations on the gas turbine because of lower pressure. Limit of gas turbine usefulness is soon reached in large sizes, particularly with present materials, because turbine design requires intimate coordination of flow velocities and peripheral velocities. Although the gas turbine can be made in much smaller sizes than the steam turbine, in this respect it is not as favorable as the internal combustion engine, since rotative speeds are likely to be high.

Another important point is that the control of the plant is centered wholly in the fuel circuit, so that valving is not practicable, and extra-high precision of pressure-flow characteristics is required.

The addition of electric or hydraulic drive is required for the application of gas turbines to ships or locomotives, he said, since turbines are not reversible.

For the aircraft field, problems are complicated by stringent demands for low weight and extreme range of operating conditions. At the same time, he pointed out, it is the field in which the greatest progress has been made and the greatest promise presents.

Here fuel economy is important only in relation to weight saved. A gas turbine mounted in a plane makes the plane itself part of the propulsion machinery, and evaluation of the two in combination is necessary.

Essential function of the turbine is that of raising the available energy of a certain flow of atmospheric air. This requires compressor, burner and turbine. If exhaust gas from the turbine is ejected directly, the plane is propelled by jet propulsion; if carried through additional stages of the turbine, it will generate torque for driving a propeller.

Exactly what the future role of the gas turbine will be is as yet unclear, Prof. Soderberg concluded. However, there are any number of aspects still to be explored – among them, other plausible types of fuel.

■ ■ ■

Automatic Coordination Air Traffic's Prime Need

Excerpts from paper

by **S. P. SAINT**

American Airlines, Inc.

■ Chicago, Dec. 3

(*Paper entitled "A System Specification for Air Navigation and Traffic Control Development"*)

THE air transport industry today is faced with a serious situation. Air navigation and traffic control development has not kept pace with the expanding volume of traffic. Costly delays in full utilization of the tremendous machine that industry is building now appear to be inevitable.

This is not vague apprehension. It is realistic evaluation of probable future development in the light of past history. Ocean-spanning, continent-shrinking airplanes of today are still making instrument approaches to the same weather minimums that single-engined mail planes used when instrument flying was first begun. And the traffic control system still has the same fundamental limitations it has had since taking its present basic form in the late 1930's. Cancellation because of weather has remained essentially the same for several years, and cancellation because of lack of capacity of the traffic control system is showing an alarming increase with increasing traffic density.

Interim measures can hope at best only to eliminate excessive delays from today's volume of traffic. This means – and the full significance of this fact has not yet come to the surface in industry thinking – that what has been thought of as tomorrow's problem is actually today's problem. And there is no solution to this problem immediately available.

First step in the direction of a coherent development program must be the formulation of a traffic control *system* specification by operational people. This first step stands today as the one missing link in an otherwise optimistic picture of the future of air transport.

Fleets are expanding rapidly. Larger units are being put into domestic service. Wartime acceleration of development has opened the door to a wealth of technical possibilities. Manufacturers are ready and willing to adapt the electronic tools of war to the needs of peacetime air transportation.

These valuable by-products of war will be useful, however, only in so far as their peacetime adaptation is directed by people who understand thoroughly the requirements of peacetime air navigation and traffic control. With its tremendous wartime momentum, the science of electronics is eager and willing to provide almost any device that human ingenuity might require in solving the problem. But this valuable energy is today being directed along several widely divergent and unrelated paths; the basic principles necessary to a properly coordinated development program have not yet been formulated.

Traffic control is the most complex phase of the problem and the one which threatens more than any other to limit the growth of air commerce. A central control agency is necessary; coordination of movement, the maintenance of uniform separation, and dispatching to regulate the flow of traffic can be accomplished only by a single control agency on the ground. A system that divides the responsibility between the ground and the cockpit will inevitably result in confusion and potential collision.

Traffic control exercised by human analysis, whether of posted data or of a perfected three-dimensional picture, has several very limiting characteristics. Most important is the fact that the difficulty or work load of control increases at a rate more rapid than the increase in traffic. Where flight data are posted in time sequence, all the postings within ten minutes of the flight in question must be searched for altitude confliction. If the traffic is doubled in volume, there will be twice as many flights within ten minutes, which means that twice as many data must be scanned for each individual clearance, with only half as much time available for its consideration. This means that the work load of control, which must be roughly proportional to the volume of data being analyzed, increases as the square of the increase in traffic. And this is without consideration of the third dimensional difficulty added by climb and descent from altitude to altitude. This geometrical progression of increasing control complication is believed to be an inherent characteristic of traffic movement. At the same time, the ability of the human controller to maintain proper coordination of traffic with any given set of aids will be roughly constant.

Air traffic must be coordinated and separations maintained by an automatic system on the ground. The capacity of the system should be limited only by the airspace available. It should provide maximum flexibility of movement. Safety factor should not be adversely affected by unexpected changes in the flow or pattern of traffic. And the system should make use of every known principle of safety engineering.

In order to be subject to continuous analysis, the continuous position information should be supplemented with continuous information regarding intended movement; that is, a zone of influence must move ahead of the flight in order to request and obtain reservation of successive airspaces before they are occupied. The principle of the completed circuit also demands that clear-

turn to p. 37 b

Student Branch News

Chartered at Case and Fenn

FORMAL charters for SAE Student Branches were presented to students of Fenn College and Case School of Applied Science at a special dinner meeting sponsored by the SAE Cleveland Section March 22.

SAE Branch Chairmen Sam Close of Fenn and Tom Cleary of Case were presented charters authorized by the SAE Council in a ceremony which recognized more than two years of effort on the part of the student organizations to achieve SAE Student Branch status.

The meeting was attended by prominent members of the Cleveland Section, including speakers, R. C. Cummings, Section Student Chairman; Section Past-Chairman R. S. Huxtable, and F. C. Crawford, Thompson Products, Inc.

Speaker of the evening was SAE Past-President A. T. Colwell. Mr. Colwell listed qualities required of a successful industrial engineer, and indicated the attributes which a student should develop during his college years.

California Institute of Technology

The Caltech SAE Branch featured a technical presentation describing the design and manufacture of valves by C. H. Bernhardt and L. E. Drake, Thompson Products, Inc., at a meeting on March 19.

Of major interest was the description of the process of upsetting stem rod to form the heads of the valves by local heating with electric resistance methods. The specifications and heat treats of the steels used were described, and discussion centered on the use and application of Stellite on the valve face and tapped end.

Cooper Union

Engineering students in the New York City area heard Robert A. Cole, Wright Aeronautical Corp., review and evaluate German aircraft powerplant development at a joint ASME-SAE meeting sponsored by the SAE Metropolitan Section at Cooper Union on March 26.

Mr. Cole's findings were based on a three month tour he made in 1945 inspecting Junkers, BMW, and Messerschmitt plants with the Air Technical Intelligence of USSTAF. Illustrating his lecture with numerous slides, Mr. Cole discussed the wartime trends of German liquid cooled and air cooled engines, turbo jets, rocket powerplants, and temperature resisting substitute materials.

Mr. Cole pointed out that in the months preceding their defeat the Germans found it necessary to halt development work on reciprocating engines in order to concentrate labor and materials on rocket and jet powerplants. It was in the latter fields that the Germans made their most striking progress.

Massachusetts Institute of Technology

First meeting of the M. I. T. SAE Student Branch for the 1946 Spring term was held on March 27, and plans were discussed for meetings and field trips to be held throughout the remainder of the term. Branch Chairman Merwin Burman announced the opening of an SAE office at M. I. T. with facilities for a library of appropriate technical journals.

Prof. Dean A. Fales gave a talk on the merits of SAE for the benefit of the new members present.

SAE Coming Events

Meeting	Date	City	Hotel
Summer (Semi-Annual)	June 2-7	French Lick, Ind.	French Lick Springs
West Coast Transportation & Maintenance	Aug. 22-24	Seattle	New Washington
Tractor	Sept. 11-12	Milwaukee	Hotel Schroeder
Aeronautic Meeting and Aircraft Engineering Display	Oct. 3-5	Los Angeles	The Biltmore
Transportation & Maintenance	Oct. 16-17	Chicago	Knickerbocker
Fuels & Lubricants	Nov. 7-8	Tulsa	Mayo
Air Transport Engineering	Dec. 2-4	Chicago	Edgewater Beach

Baltimore – May 9

Engineers Club; dinner 7:00 p.m. Engine Fuels – Before – During – After – R. E. Albright, assistant superviser, Light Products Division, Research & Development Laboratory, Socony Vacuum Oil Co. Illustrated with slides.

Chicago – May 14

Knickerbocker Hotel; dinner 6:45 p.m. Oil for the Post-War Car – H. L. Hemmingway, Technical Service Department, The Pure Oil Co.

Cincinnati – May 9

Alms Hotel; dinner 6:30 p.m. Recent Experiences in Germany – A. A. Arnhym, consulting engineer, Solar Aircraft Co. (Temporarily with Air Documents Division, Air Material Command, Wright Field) Motion Picture – German Equipment.

Detroit – May 20

Horace H. Rackham Educational Memorial Bldg.; dinner 6:30 p.m. Past Presidents Night. Diversification of Truck Use – B. B. Bachman, vice-president in charge of engineering, The Autocar Co. Powering Our Future Cars – A. T. Colwell, vice-president, Thompson Products, Inc.

Indiana – May 16

Antlers Hotel, Indianapolis; dinner 6:45 p.m. Annual Five Hundred Mile Race Meeting. Speakers – Racing Drivers, Speedway Officials, and AAA Authorities.

Metropolitan – May 17 and 23

May 17 – Pennsylvania Hotel, New York; Dinner-Dance at 7:00 p.m.

May 23 – Pennsylvania Hotel, New York; Air Transport Meeting.

Northwest – May 3

Gowman Hotel, Seattle; dinner 7:00 p.m. Speaker and subject to be announced.

Pittsburgh – May 17

Oil City, Pa., dinner 6:30 p.m. Engine Sludge Deposits – Carl Georgi, technical director, Quaker State Oil Refining Corp. 1:30 p.m. – Golf at Wanango Country Club.

St. Louis – May 15

Shell Oil Co. Refinery, Wood River, Ill.; 1:00 p.m. Field Trip to Shell Refinery. Luncheon – 5:00 p.m.

Salt Lake Group – May 13

Newhouse Hotel; meeting 8:00 p.m. Bearings – How They Are Made and How They Should Be Installed – L. M. Woodward, engineer, New Departure Division, General Motors Corp. Motion Pictures.

Southern California – May 3

Biltmore Hotel, Los Angeles; meeting 8:00 p.m. Aircraft Symposium. Investigation of an Opposed Piston Light Aircraft Engine – John Oehrli, research engineer, McCulloch Aviation. Supersonic Inspection of Material and Parts – Don Erdman, research engineer, Triplett & Barton. Integral Fuel Tank Sealing – A. S. Baker, process engineer, Lockheed Aircraft Corp. Proof Testing the DC-6 Air Conditioning System for Passenger Comfort – W. W. Thayer. A. A. Hershfield, co-author, Douglas Aircraft Co., Inc.

Syracuse – May 3

Mark Twain Hotel, Elmira; dinner 6:30 p.m. Vibrations and Ride Control in Automotive Vehicles – B. E. O'Connor, Houdaille-Hershey Corp.

Western Michigan – May 16

Occidental Hotel, Muskegon; Heavy Duty Trucks – M. C. Horine, Mack Mfg. Corp.

Williamsport Group – May 6

Swan's Restaurant; dinner 6:45 p.m. Helicopter Design Trends, Power Requirements and Control Problems – W. Laurence LePage, president, Platt-LePage Aircraft Co.

Clinton E. Stryker

CLINTON E. STRYKER has been elected president of the Adel Precision Products Corp. of Burbank, Calif. He was vice-president and assistant to the president of Nordberg Mfg. Co. of Milwaukee, and prior to that, was a partner with McKinsey, Kearney & Co., management consultants of Chicago. A graduate of Armour Institute of Chicago, Mr. Stryker was testing engineer for the Commonwealth Edison Co. from 1917 to 1919. In 1923 he joined the Fansteel Products Co., Inc., North Chicago, becoming manager of the Industrial Division, vice-president and general manager of the Ramet Corp. of America, a subsidiary, and later chief engineer of Fansteel. He was with McKinsey, Kearney & Co. for five years, becoming a partner in 1938.

JAMES H. DOOLITTLE, former commanding general of the Eighth Air Force and now vice-president of Shell Union Oil Corp., New York City, has been named to a four-year term of service with the New York City Airport Authority Board. The Authority will take over LaGuardia Field and the Idlewild Airport in Queens about Oct. 1.

G. S. GARRARD has been named chief engineer of Jacobs Aircraft Engine Co., Pottstown, Pa., a division of Republic Industries, Inc. He was formerly chief engineer of Briggs Filtration Co., Bethesda, Md.

CHARLES MARIEN, SR., has been appointed director of engineering and **W. M. MARIEN** has been named chief engineer of the Ramsey Corp. of St. Louis, Mo. As director of engineering, Charles Marien will carry forward Ramsey's extensive research program which he has headed as chief engineer for the past 16 years. W. M. Marien, who now assumes the position so long filled by his father, has for the past several years been working on developments in piston-ring engineering.

W. M. Marien

With **GAVIN W. LAURIE**, Atlantic Refining Co., as official SAE representative (see *SAE Journal*, March 1946, p. 17), the newly established Technical Advisory Board to the Army Transportation Corps includes other important SAE men in its completed membership as announced by Major-Gen. Edmond H. Leavey, chief of transportation. The other SAE men, who are serving as individuals or as representatives of other organizations, are: **GEORGE W. CODRINGTON**, president, Cleveland Diesel Engine Division, and vice-president, General Motors Corp.; **V. R. HAWTHORNE**, executive vice-chairman, operations and maintenance department, Association of American Railroads; **PAUL G. HOFFMAN**, president, Studebaker Corp.; **PYKE JOHNSON**, president, Automotive Safety Foundation; **B. FRANK JONES**, chief engineer, Autocar Co.; **J. L. KEESHIN**, president, Keeshin Freight Lines, Inc.; and **J. F. WINCHESTER**, general manager, Automotive Division, Standard Oil Co. of N. J.

JEROME C. HUNSAKER has been elected a director of the Sperry Corp. Dr. Hunsaker is chief of the department of mechanical and aeronautical engineering of M.I.T. and chairman of the National Advisory Committee for Aeronautics.

THEODORE L. PREBLE, who was recently placed on the Army's inactive list as a colonel, has returned to Tide Water Associated Oil Co. as supervisor of automotive transportation. Several weeks ago he was awarded the Legion of Merit for his more than three years of active duty. He is a former chairman of SAE Metropolitan Section and also served as a vice-president of the Society.

PETER ALTMAN, engineering consultant of Detroit, was elected a member of the Council at the 14th annual meeting of the Institute of Aeronautical Sciences. Mr. Altman's position on the Council, governing body of the Institute, is representative of the Central Area which includes the activities of Cleveland, Detroit, and Fort Worth Sections. He is a past vice-president of the SAE.

TURNER A. DUNCAN has recently become affiliated with the Eclipse-Pioneer Division of Bendix Aviation Corp., Teterboro, N. J. He was previously staff assistant to the general manager of the Scintilla Magneto Division of Bendix Aviation Corp., Sidney, N. Y.

B. ALLISON GILLIES, consulting engineer of San Diego, Calif., has been named a member of the CAA Non-Scheduled Flying Advisory Committee to represent personal flyers and other non-scheduled aviation interests in the California, Nevada, Utah, and Arizona region. Connected with the aviation industry since 1928, Mr. Gillies was first associated with the Grover Loening Aircraft Co. After serving as vice-president of Grumman Aircraft Engineering Corp. for 10 years, he went to the West Coast in 1944 to join Ryan Aeronautical Co. where he was assistant to the president.

Merger of the Edward G. Budd Mfg. Co. and the Budd Wheel Co. is currently being proposed by **EDWARD G. BUDD**, president of the two companies. The surviving concern will be known as the Budd Co. The consolidation, Mr. Budd says, "has long been contemplated in the interest of unified direction, diversification of products, and more efficient operation."

About SAE M

SYDNEY G. TILDEN, until recently a lieutenant-commander in the Navy, has returned to his company, S. G. Tilden, Inc., in Brooklyn, N. Y., where he is concentrating his attention on improving his "Permafuse" method of bonding brake lining to shoes. A former chairman of SAE Metropolitan Section, Mr. Tilden had been active on a number of SAE technical and administrative committees.

ARTHUR W. HERRINGTON, chairman, Marmon-Herrington Co., Inc., and a past-president of the SAE, has been appointed chairman of the Contest Board of the American Automobile Association, succeeding **CAPT. E. V. RICKENBACKER**, president of Eastern Air Lines, Inc. Captain Rickenbacker had held the post since 1927. "The Contest Board faces a period of unprecedented activity and responsibility," H. J. Brunnier, AAA president, said in commenting on Mr. Herrington's qualities of leadership. Discontinued during the war, officially sanctioned automobile racing will be resumed May 30 with the 500-mile sweepstakes at Indianapolis.

Arthur W. Herrington

Previously an engineer with the Cleveland Wire Spring Co., Cleveland, **J. W. MORRISON** is now product and sales engineer with the Illinois Coil Spring Co., Chicago.

LaVERNE B. RAGSDALE has joined Fisher Body Ternstedt Division of General Motors Corp., Detroit, as an engineer. He was formerly president of Ragsdale & Co., New York City.

Previously test engineer working on carburetors, Wright Aeronautical Corp., Paterson, N. J., **WALTER M. JORDON** is now associated with the American Bosch Corp., Springfield, Mass.

W. N. WAINWRIGHT, who had been connected with McQuay-Norris Mfg. Co., St. Louis, Mo., is now associated with the Sterling Aluminum Products Co., same city.

Members

Arnold Lenz has been appointed manufacturing manager and Earle S. MacPherson has been named chief engineer of the newly created Chevrolet Light Car Division of General Motors Corp. Production of the new light car at the Parma and Brook Park, Ohio, plants is scheduled to begin about the middle of 1947. Mr. Lenz was SAE Production Engineering vice-president in 1943 and has played a prominent part in the work of the SAE Production Engineering Activity

Arnold Lenz

Earle S. MacPherson

A. A. MAYNARD, who had been chief engineer of General Motors of Canada, Ltd., is now director of engineering and products study for the Canadian operations section under General Motors' vice-president, **C. L. McCUEN.** Mr. Maynard has made his headquarters at Room 3-148 General Motors Building, Detroit.

B. FRANK JONES has become chief engineer of the Autocar Co. of Ardmore, Pa. Recently resigned from the White Motor Co., he served as engineer in charge of all engineering problems growing out of the organization's war work. Before World I he was assistant chief engineer of the J. P. Devine Co. of Buffalo. He left in 1918 to become flying boat production engineer with the Curtiss Aeronautical Co., which later became the Curtiss-Wright Corp., of Buffalo.

B. Frank Jones

At the end of World War I, Mr. Jones joined the Pierce-Arrow engineering staff in Buffalo and became chief engineer of the Truck Division. At the time of the temporary merger of Pierce-Arrow and White, he joined the White organization in Cleveland, and in 1932 became chief engineer of White's Indiana Division and assistant chief engineer of the company.

BEN F. JONES, the son of **B. FRANK JONES,** is now director of aeronautical research with the B. F. Goodrich Co. He joined the Goodrich organization shortly after his graduation from the University of Michigan in June, 1940, and has served since then as an engineer in the testing laboratories and as manager of the de-icer development and research department.

J. S. LAWRENCE, United States Rubber Co., has been transferred to the Denver branch of the company where he is district manager of the Mechanical Goods Division. He was formerly sales engineer at the Wichita, Kans., branch of the firm. Mr. Lawrence recently resigned as chairman of SAE Wichita Section because of his transfer.

ALBERT A. ARNHYM, Solar Aircraft Co., who has just returned from six-months' service with Air Forces Intelligence in Germany and England, has begun a tour of duty with the Air Documents Division of Intelligence (T-2), Air Materiel Command, Wright Field, in order to assist in making available to American industry a vast store of technical documentary material captured in Germany. The job involves screening, processing, and cataloging some 500,000 items – a tremendous job if it is to be completed fast enough to be useful, Mr. Arnhym writes to the SAE. "It should be taken care of by a sufficient number of qualified engineers," he says, "with at least some knowledge of the German language – yet we have only a few people who can speak German and even fewer engineers . . . at the same time industry is waiting impatiently, too, for the material to start flowing out of Wright Field . . . we need and would very much welcome assistance from industry."

MATTHEW LAWMAN, JR., who had been a design engineer with the Reynolds Metals Co., Richmond, Va., has recently joined the Allison Division of General Motors Corp., Indianapolis, Ind., as test engineer working on experimental engines.

Formerly sales engineer in the Los Angeles branch of the Standard Oil Co. of Calif., **HENRY T. GRAHAM** is now a member of the training section, marketing personnel, in the San Francisco branch of the same company.

Until recently a production engineer with the U. S. Army, Ordnance Department, Birmingham Ordnance District, Birmingham, Ala, **OTTO J. DOEPEL** is now an engineer with the Metal Products Corp., Miami, Fla.

CHARLES H. KANAVEL, with the B. F. Goodrich Co. since 1933, has been named district manager of the company's automotive, aviation, and government sales division with headquarters in Los Angeles. Previously manager of the industrial tire and truck department in Akron, Ohio, Mr. Kanavel has held various positions with Goodrich's production, engineering, and development organizations. He was assistant manager of government sales in Washington, D. C., and also served as manager of the war products department during the war period.

RALPH F. PEO, who announced his resignation as a member of the board of the Houdaille-Hershey Corp. and general manager of the Houde Engineering Division in October of last year, has assumed the presidency of Frontier Industries, Inc., of Buffalo, N. Y. Frontier Industries is a holding corporation for a group of parts manufacturing plants.

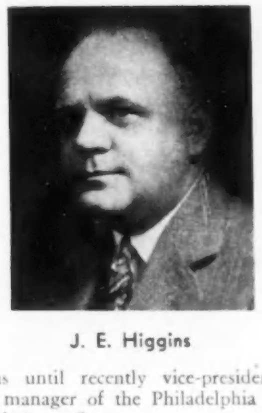
C. WILLIAM WITHEROW has recently joined the Auto Spring Co., Inc., Winston-Salem, N. C., which specializes in the manufacture and repair of automobile and truck springs. He was formerly an engineer with the Briggs Filtration Co., Bethesda, Md.

Formerly research engineer with the Standard Oil Co. of Ind., Whiting, Ind., **JOHN O. EISINGER** is now manager of the Builders Supply Co., Bethesda, Md.

ROBERT S. JOHNSON has recently become affiliated with the American Cyanamid Co., Plastics Division, Wallingford, Conn., as maintenance engineer.

T. B. MARTIN, formerly section engineer, Aeroproducts Division, General Motors Corp., Dayton, Ohio, has become a development engineer working on gas turbines with the Northrup-Hendy Co.

J. E. HIGGINS has been elected president of Truck Specialties Co. of Harrisburg, Pa.



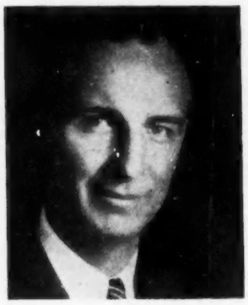
J. E. Higgins

He was until recently vice-president and district manager of the Philadelphia branch of the Autocar Co.

After having completed over five years of Army service, **MAJOR H. M. COOPER-RIDER** is now on terminal leave from Fort

Sheridan, Ill. Entering the Army in February, 1942, as a first lieutenant, Major Cooperrider was first assigned to the Detroit Ordnance District where he served as contracting officer's representative with the Tank Branch. The major has received the Ordnance Department Certificate of Commendation for his work in the Detroit District. Before his entry in the Army, he was associated with the GMC Truck & Coach Division of General Motors Corp. in the Experimental Department.

N. E. HENDRICKSON has resigned as vice-president and chief engineer of the



N. E. Hendrickson

Mather Spring Co. of Toledo, Ohio, and is now located on the Pacific Coast where he will soon be engaged in consulting engineering and metallurgical work.

A group of nationally-known aviation leaders which cooperated in wartime aviation research with the Harvard University Graduate School of Business Administration will continue work as an advisory committee in the school's postwar programs. The committee, headed by **WILLIAM A. M. BURDEN**, consists, in part, of SAE members **R. S. DAMON, ROBERT E. GROSS, JOHN A. HERLIHY, ALFRED MARCHEV,** and **EDWARD WARNER**.

RICHARD H. DEPEW, JR., plans to return to the aviation industry as vice-president in charge of operations for Ludington-Griswold, Inc., Saybrook, Conn. He has recently resigned as chief of the Aircraft Sales Division of the Office of Aircraft Disposal, War Assets Administration, Washington, D. C.

W. B. WATTERSON has become sales manager of the Air-Maze Corp., Cleveland. Until recently factory representative for the

W. B. Watterson

Ohio territory with the same company, Mr. Watterson has been connected with Air-Maze since 1942 in various sales promotional capacities.

COL. A. CARYL BIGELOW, now on terminal leave after nearly six years of service in the Army, is living at Elm Road and Cleveland Lane, Princeton, N. J. From chief of the Technical Service Division at Camp Holabird, where he was in charge of the Army's extensive training bulletin program and publishing executive of *Army Motors*, Colonel Bigelow's first overseas assignment was liaison officer on the staff of Lord Louis Mountbatten in India and thence to Iran in charge of trucks hauling supplies into China over the Stilwell Road. This command operated more than 30,000,000 truck miles, and the colonel won a laudatory citation for his achievement. He had high praise for trucks and other automotive equipment produced by American industry.

HARRY S. RICHER has, as a partner-owner, established the Elder-Richer Engineering Co. to offer engineering service in the Southern California area. Mr. Richer feels that the best solution to the problems of rising labor costs and rigid price ceilings lies in lowered operating cost, which can be made possible by competent engineering of the product and its fabrication.

E. J. FOLEY has been appointed assistant to the vice-president in Washington, D. C., of American Airlines, Inc. Mr. Foley, who holds an aeronautical engineering degree from the University of Detroit, joined American Airlines in May, 1943, as assistant to the vice-president of engineering. Subsequently, he performed special and technical assignments for various departments. He recently has been supervising the streamlining of operating regulations and procedures at American Airlines headquarters in New York City. He is vice-chairman for Air Transport Activity of SAE Metropolitan Section.

Formerly a student member at Ohio State University, Columbus, Ohio, **NORMAN HOPWOOD, JR.,** is now a student engineer with Ford Motor Co., Dearborn, Mich.

HARLEY J. URBACH has been appointed works engineer of the Research and Development Division of the Timken Roller Bearing Co., Canton, Ohio. Joining the Timken organization in 1933 shortly after his graduation from the University of Nebraska, Mr. Urbach started in the Railroad Engineering Department. He was sub-

Harley J. Urbach

sequently transferred to the Fuel Injection Equipment Division of the Engineering Department and, in 1940, to the Works Engineering Department.

BENJAMIN H. ADAMS has been elected vice-president and treasurer of the Myrastone Products Co., Philadelphia. He was formerly sales manager and vice-president of W. G. B. Oil Clarifier, Inc., Kingston, N. Y.

Formerly design leader with the Sperry Gyroscope Co., Inc., Garden City, L. I., N. Y., **ANDRE R. BRAULT** is now designing engineer with the Austin Co., New York City.

Until recently a student member at M.I.T., Cambridge, Mass., **DAVID H. HU** is now a representative in New York City of the Great China Motor Co., Shanghai, China.

Formerly mechanical engineer with the National Advisory Committee for Aeronautics, Langley Field, Hampton, Va., **CARLOS R. BELL** may now be reached c/o General Motors Overseas Operations, New York City.

T. V. BUCKWALTER, former vice-president of the Timken Roller Bearing Co., and **LEWIS A. RODERT,** Stewart-Warner Corp., have been awarded, respectively, the George R. Henderson and the John Price Wetherill medals of the Franklin Institute. Awarded the Henderson medal "in consideration of his accomplishments in applying anti-friction bearings to railroad locomotives and cars," Mr. Buckwalter retired as vice-president of Timken in 1945. Mr. Rodert, who receives the Wetherill medal for his "important and applied work in developing a thermal ice prevention system for airplanes," joined Stewart-Warner in 1945. Prior to that, he was a research engineer for the NACA.

PETER BLACKWOOD, foundry superintendent, Ford Motor Co. of Canada, Ltd., will be 1946 recipient of the John H. Whiting gold medal of the American Foundrymen's Association, and **HYMAN BORNSTEIN,** director of the testing and research laboratories, Deere & Co., will receive the association's William H. McFadden gold medal. Mr. Blackwood was a member of the subcommittee on centrifugal casting of the Aluminum Castings Committee of the SAE W.E.B.

COL. VALENTINE GEPHART, USMCR, has been awarded the Legion of Merit in recognition of outstanding services rendered while he was commanding officer of Marine

Col. Valentine Gephart

Air Base Group Two, North Island, San Diego, Calif. He was lauded for his "engineering ability, leadership and devotion to the fulfillment of an important assignment."

ENS. K. L. ZINSU, USNR, who was stationed at the University of Minnesota, Minneapolis, has been transferred to the Naval Training School at Patuxent River, Md.

ARTHUR H. HERTS has formed Arthur Herts & Co., Inc., and will be engaged in the import-export business specializing in automotive equipment. Mr. Herts has made his headquarters in New York City.

E. W. McKAY, Bendix-Westinghouse Automotive Air Brake Co., has been named southeastern regional manager of the organization. He was formerly eastern regional manager of the same company with offices in Philadelphia.

Formerly assistant general superintendent, Wickwire Spencer Steel Co., Buffalo, N. Y., B. L. McCARTHY is now chief metallurgist serving with the Colorado Fuel and Iron Division of the same company

E. DOUGLAS STINSON, JR., has established the Diesel Technical Service and Supply of San Diego, Calif. He was until February field service representative with the Cleveland Diesel Engine Division of General Motors Corp., Los Angeles. JACK M. RADKEY, who was formerly a captain with the U. S. Army Corps of Engineers in Brisbane and Sydney, Australia, is affiliated with Mr. Stinson as service manager of the firm.

Formerly a student member at Purdue University, West Lafayette, Ind., H. C. THORMAN is now an ensign in the USNR and is stationed at the Naval Air Station at Olathe, Kans.

CHARLES A. BARESCH, who had been experimental test engineer with Pratt & Whitney Aircraft, division of United Aircraft Corp., East Hartford, Conn., has become a project engineer with Associated Aeronautical Engineering & Research Corp., Trenton, N. J.

Until recently deputy chief inspector of the Aircraft Branch, War Assets Corp., Montreal, Que., Canada, GEORGE S. LACE has been appointed supervising inspector for the Montreal area with the Civil Aviation Branch, Department of Transport.

Formerly test engineer with Wright Aeronautical Corp., Paterson, N. J., GILES W. PAINTER is now development engineer with the Lord Mfg. Co., Erie, Pa.

Until recently research chemist with the Commercial Solvents Corp., Terre Haute, Ind., HAROLD G. JOHNSON is now affiliated with the Dykem Co. of St. Louis, Mo.

R. J. McCRACKEN has joined the Salisbury Axle Division of the Spicer Mfg. Corp., Fort Wayne, Ind. He was formerly associated with the Durham Mfg. Corp., Fort Wayne Division.

EDWARD C. BREINIG has recently become affiliated with the Reynolds Metals Co., Corinth, Miss., as an hydraulic engineer.

WILLIAM H. KILDOW, JR., who had been associated with R. W. Greeff & Co., New York City, is now district manager of the Shell Chemical Corp., Chicago.

Formerly designer with Pratt & Whitney Aircraft, division of United Aircraft Corp., East Hartford, Conn., EDWIN F. KATZ is now research engineer at Battelle Memorial Institute, Columbus, Ohio.

SAE MEMBERS who have received recent changes in company status are: ADOLPH O. LEE, University of Minnesota, Minneapolis, Minn., from instructor in the mechanical engineering department to assistant professor; JERE T. FARRAH, American Airlines, Inc., LaGuardia Field, New York, N. Y., from specifications engineer to chief industrial engineer; WILLIAM H. PARISH, JR., Bendix-Westinghouse Automotive Air Brake Co., Elyria, Ohio, from field representative to southern regional manager; NORMAN L. CROOK, Boeing Airplane Co., Wichita Division, from junior aerodynamicist to lead aerodynamics engineer.

DAVID M. ROBERTS, Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., from field engineer in the Aeronautic Division to design test engineer; ROBERT B. INGRAM, Aviation Corp., Lycoming Division, Williamsport, Pa., from experimental test engineer to assistant supervising engineer; HUGH G. BOWLES, Allison Division, General Motors Corp., from junior engineer to project engineer; JOHN W. BORGQUIST, Lockheed Aircraft Corp., Burbank, Calif., from staff assistant in the conservation department to plant layout engineer.

J. LARRY ANDERSON, Maritime Oil Co., Houston, Tex., from lubricants engineer to domestic sales manager; LORAIN N. VANDERVOORT, Weatherhead Co., Cleveland, from project engineer to senior development engineer; JOSEPH N. WITTKO, Grumman Aircraft Engineering Corp., Bethpage, L. I., N. Y., from layout draftsman to production powerplant engineer; L. EUGENE EASLEY, Allison Division, General Motors Corp., from engineer in charge of test standards to supervisor of plant clearance. WARREN J. DUBSKY, Cleveland Diesel Engine Division, General Motors Corp., from development test foreman to laboratory technician.

THOMAS L. COWLES, Studebaker Corp., South Bend, Ind., from aviation engineer to export engineer; STUART P. MILLER, E. I. du Pont de Nemours & Co., Inc., Detroit, from plastic engineer to field engineer; PHILIP B. FREEMAN, Ranger Aircraft Engines, Farmingdale, L. I., N Y, from field engineer to assistant manager of the field engineering department; ROY B. FISHER, Pratt & Whitney Aircraft, East Hartford, Conn., from layout draftsman to designer; FRANCIS J. LOWEY, S. K. Wellman Co., Cleveland, from project engineer to product design engineer; JOHN A. NEWTON, Thompson Products, Inc., Euclid, Ohio, from service engineer to assistant valve engineer.

GEORGE F. HAGGER, Chance Vought Aircraft Division, United Aircraft Corp., Stratford, Conn., from assistant powerplant group engineer to group engineer, powerplant design; BEAL P. MOORE, Curtiss-Wright Corp., Propeller Division, Caldwell, N. J., from experimental test engineer to laboratory test supervisor; W. B. FLANDERS, Wright Aeronautical Corp., from assistant project engineer in the Cincinnati, Ohio, branch, to project engineer in the Paterson, N. J., branch.

RAYMOND D. MAINS, Fruehauf Trailer Co., from sales manager of the Chicago branch, to general sales manager of the Detroit branch; THEODORE C. BOSLER, Allison Division, General Motors Corp., from head contact engineer to special assignment work; EDWIN W. PASCOE, Wright Aeronautical Corp., from senior project engineer at Lockland, Ohio, to project engineer at Paterson, N. J.; P. H. ENOCHS, Union Oil Co. of Calif., from office manager of the San Francisco branch, to product service representative at the Los Angeles branch; JOHN J. AMBROGIO, Mack Mfg. Corp., Plainfield, N. J., from engine designer to liaison engineer; JOHN V. EAKIN, Fawick Airflex Co., Inc., from service manager in the Cleveland plant, to district manager of the mid-continent area.

Formerly engineering officer, Bureau of Aeronautics, resident representative, Westinghouse Electric Corp., Essington, Pa., GEORGE C. SCOTT, JR., has rejoined the Commercial Filters Corp., Boston, Mass., as an engineer. Mr. Scott had been associated for almost four years with the Commercial Filters Corp. before joining the Bureau of Aeronautics in 1943.

DAVID J. LITTLE has become associated with Healthair Products Co., San Antonio, Tex., where he is serving in the capacity of engineering manager in charge of development of a new line of absorption type of air conditioning units, evaporative cooling units, and humidity control equipment. Mr. Little, who developed some of the equipment manufactured by his firm, was previously a design engineer with the Detroit Gear Aircraft Division of Borg-Warner Corp.

Formerly senior test engineer with Hamilton Standard Propellers, East Hartford, Conn., JOHN B. BUTLER is now customer contact engineer with the Edward G. Budd Mfg. Co., Philadelphia, Pa.

E. J. YOUNG has become industrial sales engineer with the Shell Oil Co., Inc., Indianapolis, Ind. He was formerly customer engineer with Bendix Products Division of Bendix Aviation Corp., South Bend, Ind.

Previously experimental engine tester with Wright Aeronautical Corp., Paterson, N. J., RUSSELL L. FENN, JR., has recently joined the Sun Insurance Office, New York City, as underwriter in the Automobile Department.

R. F. SIMMONS, JR., who had been advertising manager with the Briggs Clarifier Co., Washington, D. C., is now assistant sales promotion manager in the Tire Division of the United States Rubber Co., New York City.

Formerly production supervisor, USAAF, Los Angeles, Calif., PHILIP L. SULLIVAN is now production foreman of the Harvill Corp., same city.

LT. M. W. LARINOFF, USNR, returned to the United States for the Christmas holidays after serving 23 months overseas duty

in the Pacific as engineering and repair officer of PT boat bases. His last station was in the Philippines with PT Boat Base No. 17, one of the largest of its kind.

MARSHALL D. McCUEN has recently become senior project engineer with the Oldsmobile Division of General Motors Corp., Lansing, Mich. He was formerly supervisor of the production engineering group, engineering department, Allison Division, General Motors Corp., Indianapolis, Ind.

GEORGE ELLIS is now manager for training with General Motors Holden's, Ltd., Pagewood, New South Wales, Australia. He was formerly a chartered automobile engineer with the same company.

Formerly a student member at the University of Wisconsin, Madison, Wis., **GEORGE A. JOHNSON, JR.,** is now in the USNR and is stationed in Shanghai with the Seventh Fleet.

MOU-CHE LIU, who has during the war been attached to the Chinese Supply Commission, Washington, has returned to China where he will be associated with the Ministry of Communications, Aeronautical and Navigational Department, Nanking, China.

JOSEPH E. ROBBINS has been elected president and general manager of Shine-Phillips, Inc., Los Angeles. He was formerly manager of the technical department of Paramount Pictures, Inc., same city.

Previously chief engineer with C. D. Beck & Co., Sidney, Ohio, **WILLIAM H. MORITZ** is now serving in the engineering department of the Checker Cab Mfg. Co., Kalamazoo, Mich.

RALPH L. JOHNSTON has recently formed the Johnston Permanent Mold Design Co., Detroit, which specializes in permanent mold engineering. He was previously a designer with the Aluminum Alloys Corp., same city.

Formerly chief of the inspection department, U. S. Army, Ordnance Department, Watertown Arsenal, Watertown, Mass., **RICHARD U. BRYANT** is now production engineer with the Singer Mfg. Co., Bridgeport, Conn.

H. S. DRINKER has terminated his connection with Eclipse-Pioneer Division of Bendix Aviation Corp, Teterboro, N. J., where he served as engineer in charge of the experimental machinery shop, and has joined Specialties, Inc., Syosset, L. I., N. Y.

MORTON P. MATTHEW has recently become affiliated with the De Laval Steam Turbine Co of Trenton, N. J., and is serving in the capacity of project engineer.

Until recently senior test engineer with Wright Aeronautical Corp., Lockland, Ohio, **WILLIAM H. MOORE, JR.,** is now special development engineer with the GMC Truck & Coach Division of General Motors Corp., Pontiac, Mich.

WILLARD W. PARKER has been named secretary-treasurer of Green Lake Airports, Green Lake, Wis. He was assistant to the manager of the installations department of Curtiss-Wright Corp., Propeller Division, Caldwell, N. J.

ROBERT H. PETERSON, who had been development engineer with the Stromberg Aircraft Carburetor Division of Bendix Products Division, South Bend., Ind., is now serving in a similar capacity with the Radio Corp. of America, Lancaster, Pa.

H. M. PAGE has become assistant manager in charge of service, engineering, and training of the newly organized Fleet Department of Chevrolet Motor Division of

H. M. Page

General Motors Corp. A 14-year member of Chevrolet, Mr. Page was director of the war products field organization during the war period.

Formerly junior engineer with the Chrysler Corp., Highland Park, Mich., **A. EMMETT CARPENTER** is now an engineer in the powerplant department of Beech Aircraft Corp., Wichita, Kans.

Formerly a mechanical engineer with the National Advisory Committee for Aeronautics, Aircraft Engine Research Laboratory, Cleveland, **ARTHUR W. BULL** is now a project engineer with the King-Seeley Corp., Ann Arbor, Mich.

WALTER M. JOHNSON has been named superintendent of transportation and maintenance, machine shop and metal construction of Hal Roach Studios, Inc., Culver City, Calif. He was formerly superintendent of production with Lockheed Aircraft Corp., Dallas, Tex.

DANIEL H. LAMB has recently become affiliated with the Perfex Corp., Milwaukee, Wis., as research engineer in the Radiator Division.

Until recently senior technical assistant, Ministry of Supply, London, England, **E. O. WHITFIELD** is now assistant controller, Vehicle Maintenance Section, Control Commission for Germany, British Zone, Hannover Region, Germany.

D. C. WATTS has become a machinist with Kay-Mar Products, Hollywood, Calif. He was plant operator with Alberta Nitrogen Products, Ltd., Calgary, Alta., Canada.

Previously manufacturing engineer and tool designer with Lockheed Aircraft Corp., Burbank, Calif., **L. J. PITMAN** is now a mechanical engineer with C.I.T., Pasadena, Calif.

Formerly a student member at CCNY, New York City, **N. D. YUELYS** is now serving with the Stratos Corp., Babylon, L. I., N. Y.

VERNE F. NELSON, Weatherhead Co., who was assistant plant superintendent of the Cleveland branch, is now manager of the Angola Division of the same company.

Previously research chemist with the Chrome-Rite Co. of Chicago, **E. H. McCOY** has recently joined the E. R. Frost Co. of Minneapolis, Minn., where he is serving as a chemical engineer.

HENNING KARLBY, Elastic Stop Nut Corp. of America, Union, N. J., has been appointed assistant to the president. He formerly served with the same organization as chief research engineer.

Formerly production engineer with the Chrysler Corp., Chrysler Tank Arsenal, Centerline, Mich., **GEORGE F. STACY** is now an electrical designer with Hudson Motor Car Co., Engine Division, Detroit.

R. W. ST. AUBIN, previously foreman, American Airlines, Inc., LaGuardia Field, New York, N. Y., has been transferred to American Overseas Airlines, Inc., and is now serving in Ayrshire, Scotland.

Formerly foreman, product test department, Pratt & Whitney Aircraft, division of United Aircraft Corp., East Hartford, Conn., **C. F. PARKER** is now service engineer with the Van Norman Co., Springfield, Mass., in the Cleveland, Ohio, territory.

WALTER F. ROEMING has recently joined the Oliver Farm Equipment Co., Charles City, Iowa, as project engineer. He had been designing engineer with the National Supply Co., Springfield, Ohio.

Formerly owner of the Henry A. Powis Machinery Co., Santa Monica, Calif., **H. A. POWIS** is now president of the Reypo Corp., Los Angeles, manufacturers of machine tools.

A. G. TSONGAS, who was chief division engineer, Stinson Division, Consolidated Vultee Aircraft Corp., Wayne, Mich., has recently become chief project engineer on personal aircraft at the San Diego, Calif., branch of the same company.

Previously assistant plant engineer with the Indiana Glass Co., Dunkirk, Ind., **MELVIN N. OSBORN** has joined the Waco Aircraft Co., Troy, Ohio.

R. E. FORBESS, formerly a student member at the University of Wisconsin, Madison, Wis., is now an ensign in the USNR and is stationed at the Naval Air Station at Glenview, Ill.

H. W. KLAS has recently joined Ford Motor Co., Research Laboratories, Dearborn, Mich., as development engineer. He had been senior project engineer with Packard Motor Car Co., Toledo Division.

Formerly senior engineer, Aeroproducts Division, General Motors Corp., Vandalia, Ohio, **H. ROGER WILLIAMS** is now associated with Schenck & Williams, architects, of Dayton, Ohio, and Palm Springs, Calif. Mr. Williams has made his headquarters at the Palm Springs office.

T. H. MURPHY, superintendent of diesel power, American Locomotive Co., Schenectady, N. Y., has also been named administrative assistant to the director of engineering. **H. B. DHONAU,** who had been assistant chief design engineer of the 2-cycle diesel division of American Locomotive, has recently become assistant department head of the same division.

Formerly chief engineer of the China National Aviation Corp., Calcutta, India, **MARTIN GARROTT** is now superintendent of line station maintenance, Pan American Airways, Inc., LaGuardia Field, New York, N. Y.

American Automobile Contributions Cited

Digest of paper

by RALPH E. FLANDERS*

■ New England, Feb. 5

(*Paper entitled "The Automobile in the American Economy"*)

FROM its inception as an industry, Mr. Flanders pointed out, automobile production has grown through its own momentum – increased demand made possible the inauguration of mass production methods, which in turn reduced cost and again enlarged the market. The process has continued until all but the lowest income groups have become automobile owners.

The industry not only has been the principal training ground for development of American mass production methods, he said, but also has contributed an unparalleled increase in employment, both directly and indirectly. Tremendous expansion in the fields of petroleum and tire production, highway construction, and insurance, has been an outgrowth of automobile progress. Important social effects – dispersals of population, benefits to the farmer, a broadened range of contacts and experience for the general American public through travel – are other outcomes of this mass automobile ownership.

The total contribution of the automobile to the American economy has been a net addition to the goods and services available to the common man, and a net addition to employment opportunities. And the possibilities for expansion, the author added, are almost unlimited in the postwar world.

The overall picture is not all optimistic, however, he pointed out, since initial chicken and cattle problems have been replaced by far more serious difficulties of driving hazards and traffic and parking congestion.

Necessary reforms, in his opinion, are more stringent parking laws, improved parking areas, provision of suburban passenger service adequate to dissuade many commuters from driving into cities.

*Retired president, Federal Reserve Bank, Boston.

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Hydraulics Progress Advanced by Navy Usage

Digest of talk

by D. N. SMITH

Vickers, Inc.

■ So. New England, Feb. 6

(*Summary of ideas expressed by Mr. Smith in his talk on "The Hydraulic Transmission and Control of Power"*)

CONSIDERABLE use has been made of hydraulic power transmission in naval ordnance and the machine tool industry, although in the latter mostly for cycling circuits rather than transmission. Probably the Navy has done as much as any group to further power transmission and control by hydraulics.

The 8-in. gun turrets on heavy cruisers are a good illustration of naval usage. The major armament consists of three turrets, each containing three 8-in. rifles. These guns must be fired fast and accurately, from a ship moving with roll, pitch, yaw, and linear speed, to hit a moving or stationary target up to 18 miles away. Tracking of the target is done with optical equipment from the fire control bridge.

These data are sent as a continuous electrical signal to the plotting room, where the problem is automatically solved – taking account of all variables such as gun platform and target movements, wind velocity, shell trajectory, and even considering erosion of the rifle barrel from each successive shot. This problem solution is then transmitted, again electrically, to the gun turret and its power machinery.

The gun turret, only a small portion of which appears above decks, consists of a large cylinder extending almost to the keel. The turret is self-contained, including even its own magazine, and rotates as a whole on its roller bearing mounts. The system incorporates automatic correction for roll, pitch and yaw to keep the guns on target at all times. The old system, used even during World War I, required firing of the guns when they passed through an aiming point, keeping the guns fixed with relation to the ship. This greatly limited firing frequency. On modern installations, movement is done 100% by hydraulic speed gears. This is true on all guns from 5 in. up. The solution transmitted from the plotting room actuates pilot valves that regulate the variable speed gears, and motors that control the aiming of the guns.

To show the accuracy with which this complex system must control, the guns are allowed a discrepancy of one min. of angle which amounts to 18 in. at a mile, or about a 25-ft radius at 18-mile range. This same limit of accuracy applies to the 16-in. gun turrets on battleships, such as the Missouri, which weigh 1800 tons.

Almost all operations in the turrets are handled hydraulically. The powder is hoisted from the magazine in the bottom of the turret through a path interrupted in the middle to prevent flashback to the magazine. The projectile is hoisted to the rammer tray, which automatically aligns with the gun to allow loading in any position. The breech is opened and closed. The projectile and powder are loaded and the rammer tray removed. Then the guns are aimed and fired. All these operations are done by hydraulic means at a rate of 20 shots per min per gun or 60 shots per min per turret. The 8-in. projectile weighs 70 lb and the powder 40 lb.

We return now to our original discussion, narrowing to hydraulic transmission of power with positive displacement pumps and motors. These consist of gear, vane, and piston pumps and motors, each with advantages and disadvantages. Of these, the piston types are the only accurate designs. The field of variable speed transmission is most interesting. Initial attempts were made for automotive applications but are still not perfected. For this usage, positive displacement units are ideal and give complete control.

In the automotive field, hydraulic power transmission could furnish versatility, high acceleration, and flexibility to diesel switch engines. A pump coupled to the powerplant with a motor on each axle is ideal. It furnishes automatic differential and lighter weight. The same scheme could be applied to passenger automobiles. In the rolling mill field, the speed of the stock must increase as it passes through successive rolls. A central pump with separate motor on each pair of rolls would automatically give the required adjustment.

Air Traffic

cont. from p. 32

ance information be displayed to the pilot by an indication that is self-sustaining so long as all elements of the system are functioning properly. Use of continuous signal indications rather than a system of reporting at check points not only closes the communications circuit to increase the safety factor, but also increases the flexibility of the system.

Two basic improvements in navigational facilities must be achieved in order to fly airplanes closer together laterally with safety. First, the presentation of position and heading information and track guidance must be given to the pilot in greatly simplified form. Second, the indications themselves must be self-checking so that the pilot has continuous assurance that his information is reliable.

In sharp contrast with limitations of present navigational systems are the possibilities inherent in navigation on radar beacons. Flight tests have shown that precise holding patterns can be flown within an area as small as 2 x 4 miles with a degree of mental effort only slightly greater than that required to fly the airplane without consideration of the navigational problem. In addition, scope presentation of a succession of radar beacons forms a navigational device that is inherently self-checking and needs no extra devices for this purpose.

Application of such a system to the traffic problem requires only straightforward engineering; every characteristic suggested is now within reach.

It is believed that the volume of traffic that can be handled by such a system will be greater because every worthwhile advantage of radar or other devices can be incorporated to reduce the minimum practical separation between flights; movement is coordinated automatically and instantaneously; provision is made for regulatory overcontrol of the system by human dispatchers in order to distribute peak loads to the best advantage, and safety is increased by incorporation of the self-checking principles of the completed circuit.

Three-cent airlines may become the dream of the industry, but the dream will never become a reality until a sound and thorough solution is found to the air navigation and traffic control problem. This solution will not come easily. It certainly will not come until development thinking is preceded by a thorough analysis of the basic principles of the problem.

AERO MEETING

cont. from p. 19

years the 1000 mph that has already been predicted by NACA, the authors warned that the designs will have to undergo considerable change, particularly with respect to surface smoothness and contour fairness, which becomes increasingly important at higher speeds, and as to sweepback, which, as Mr. Soulé explained, will have to be increased to perhaps 45 deg, accompanied by a reduction in chord thickness to a minimum.

Test results of the thick-skin monocoupe wing are most encouraging, Mr. Mathes concluded. The monocoupe magnesium wing withstood 113% of ultimate load in static test and showed a strength-weight advantage of 22% over the production aluminum wing.

Advocates for the increased use of magnesium included Dr. A. L. Klein, Douglas Aircraft Co., Inc., and C H. Kitchell, Taylorcraft Aviation Corp.

Further trouble with the use of magnesium in sheet form is due to the fact that hot forming is necessary, which Mr. Mathes thought was studiously avoided by most shops. Dr. Klein said, however, that he felt there was not as much resistance to the hot-forming methods today as there used to be.

Although the sheet magnesium came in for the most criticism, R. C. McGuire, American Airlines, Inc., told about a brake torque arm magnesium casting that had failed.

Airplane Tires

Progress of the past decade has touched practically every functional component of the airplane – involving new designs, new materials, new metallurgy, new levels of resistance to heat, to stress, and to fatigue, new techniques and precisions of manufacture, and perhaps most of all, new concepts in the economics of conveying mass through space at high velocity.

The paper "Pneumatic Tires for Modern Airplanes" by R. D. Evans of the Goodyear Tire & Rubber Co. portrayed how this progress in tires has been achieved for commercial transport. It also presented an analysis of the factors on which it has been based and offered some opinion as to trends and possibilities of the next five years.

Mr. Evans reported that in the last 10 years the ratio of load rating to total tire and tube weight has improved 33%, that the ratio of load rating to envelope volume has increased 70%, and that inflation pressures have been stepped up from 48 to 59-80 psi.

Because of its better bruise resistance and higher unit strength, rayon chord has displaced cotton during this period, thus permitting a substantial overall weight reduction.

Nylon chord has also been developed, but full advantage of this material cannot be taken, it appears, to increase the ratio of load rating to total tire weight because the designer must take into consideration not only the unit strength of the material but also such factors as bead action, stability, chord fatigue, interply shear stresses, and growth.

Although tires have been built in sizes up to 110 in. overall diameter, Mr. Evans thought that the optimum size was nearer to 40 to 60 in. overall diameter.

Dr. Klein presented the point of view of the airplane designer. He told how the DC-1, originally planned to weigh 13,000 lb was finally built to 18,000 lb but using the same tires that had been planned for the original weight. Then the wheels of the DC-3 were designed to use the same rim diameter, so that the 600 landings that had been possible with the lower weight were reduced to 400 landings.

It has been estimated, he said, that only about 20 lb increase in the weight of each tire would be needed to bring the life back up to the 600 landings, but this additional 40 lb that the airplane would have to carry around would cost the airlines $2000-3000 in maintenance.

Engine Installation

The NACA cowling, which was introduced in 1929, reduced drag of the engine installation by more than 75%, but cooling difficulties began to be experienced because of the reduction of airflow over the cylinders caused by the low air velocities within the cowl.

By 1934 cooling with the NACA cowl was improved to the point where it could be used on two-row radial engines by the addition of pressure baffles and cowl flaps.

A report of recent wind tunnel tests that have been conducted on model aircooled engine nacelles, as well as a step-by-step analysis of a new method for estimating the airflow through, and drag of, naturally aspirated radial aircooled engine installations was given by Frederick V. H. Judd of United Aircraft Corp. in his paper "Systematic Approach to the Aerodynamic Design of Radial Engine Installations."

A written discussion of Mr. Judd's paper was read by Chairman R. R. Higginbotham, who pointed out that engine finning and baffling has been so much improved, in an attempt to meet severe cooling conditions that it is difficult to keep the engine warm enough under easy cooling conditions, such as winter cruising. For certain types of aircraft designed for cooling at high altitudes, he continued, engine cut-out in auto-lean cruising has been experienced due to excessively low cylinder-head temperatures.

Mr. Judd reported that any asymmetrical temperature condition, such as local hot spots, or any condition that causes an asymmetrical flow through the cowl, such as engine obstruction, partial cowl flaps, or operation of the cowl at other than zero degrees angle of attack, causes an increase in the cooling drag.

W. M. S. Richards, Wright Aeronautical Corp., reported that on the B-29 the cowl originally had no overlap on the afterbody. It was thought that if the size of the afterbody could be decreased slightly to give a small overlap, cooling would be increased. It turned out that this was impossible because of the amount of equipment just inside the cowl, so that it was necessary to increase the cowl diameter instead, thus accomplishing the same result.

Aerodynamic results just aren't realistic enough, according to Dr. Klein, who said that engines are overcooled because it is impossible to close down the flap openings enough. The jet action of increased exhaust velocity gives immediate increased cooling upon the throttle opening; therefore, he said, the jet stack and cowl flap should be avoided in the future.

John G. Lee, United Aircraft Corp., was in favor of ejector cooling. It is better, he said, to have a slight overlap so as to give some mixing, which doesn't require the 100 lb of heat installation that Dr. Klein claimed, he added.

Emphasis should be placed on operational simplicity for the safe use of personal planes, according to J. M. Gwinn, Jr., in his paper "Simplifying the Airplane for the Private Owner." Paradoxically, this may mean designing a more complicated mechanism. Thus engineers should be prepared to:

1. Provide sufficient visibility so that obstacles likely to produce a collision force themselves on the pilot's attention. Another solution to this problem is the use of radio and radar, although contact flying will always be desirable for the private owner, especially for landings.

2. So relate the components of the airplane to the pilot that no accident is likely to be caused by his careless motions. This will necessitate the spacing of the controls so that in moving one control, the pilot will not inadvertently move another. The interior should be arranged so that the controls will not be accessible to the passengers.

3. Reduce the number of controls so that the necessity for pilot coordination will be reduced to the minimum.

4. Eliminate the need for depth perception by simplifying landing glide and landing technique. Airplanes now approach with part power, and with continuous use of throttle for glide control. The nearer the approach speed is to the landing speed, the simpler will be the approach and landing technique.

Errors in technique and judgment are responsible for 51% of all accidents. Of these, 42% were charged to wrong techniques and 9% to poor judgment. One might assume that visibility was a major cause of collisions. Since collisions with other objects are nine times as frequent as collisions with other planes, it is evident that lack of ability to see was not the major cause.

Fire in the air and structural failure are the two principal types of accidents which can be caused by malfunction of the airplane. Forced landings themselves are usually caused by engine failure.

5. Reduce minimum cruising speed to allow for shorter visibility range.

Use of personal aircraft should be encouraged to accelerate expansion in this field, stated W. T. Piper, Piper Aircraft Corp. This will require a nationwide network of airports and more hangar space. These airports should be marked with numbers and colored lights to guide the pilot in landing and also for ease of identification.

The flying public must be encouraged to construct their own backyard hangars with areas large enough for takeoffs and landings. These will then probably be as common as garages.

Because the majority of private pilots will be very inexperienced, it will be important to design more simplified controls, thus eliminating the need for pilot coordination. Spare parts should readily be made available for rapid servicing.

Personal airplanes must be economical, operation costs must be reduced to a minimum.

The airplane is basically a long trip machine, and because the average man does not make very many such trips during his life time, planes should be available for hire.

Although the CAA regulations will determine the flying speed and will enforce other regulations to make all safer pilots, there will always be the hazard of bad weather. The author predicted more NACA research in the field of the private plane.

Air TRANSPORT Sessions

CHAIRMEN

John M. Chamberlain, Civil Aeronautics Board Wilfred W. Davies, United Air Lines, Inc.
J. C. Franklin, Transcontinental & Western Air, Inc.

AFTER years of skillful adaptation of scarce equipment to unprecedented demand, the air transport industry is pausing briefly to take stock of itself and its future, it was seen at the Air Transport Sessions.

Equipment developed and techniques learned in response to the all-out needs of war are being evaluated and considered for peaceful enterprise. This reorientation was shown clearly as air transport experts peered into postwar prospects of airlines becoming a more important adjunct to railroad, highway and ocean transportation.

Means of accomplishing this ambitious purpose were outlined by six speakers, modified and expanded by numerous aircraft designers and air line operators who took part in the discussions.

Common denominator present in all calculations is cost: the cost of producing a new type aircraft has become more tremendous each year, but at the same time price per passenger mile must be considerably reduced if air transport is to maintain its war-boosted volume.

As airlines enter a new, important and slightly hazardous period in their development, safety must be an inviolate rule. Jerome Lederer, Aero Insurance Underwriters, pointed out in his paper "For Whom the Bell Tolls: Notes on Safety in Airline Operations," that despite the improving flight safety record, serious accidents become a greater danger with larger planes carrying more passengers. In addition, one serious accident can set back not one airline, but the entire industry.

Rescue operations need reorganizing to take cognizance of the increasing magnitude of rescue problems; engineers and manufacturers also can contribute to improved rescue operations by safer layout of vulnerable airplane parts and equipment.

Automatic fire detection, careful crew training, and fireproof design elements can reduce the fire hazard greatly. In fact, Mr. Lederer pointed out, the only natural obstacle to safe flight which is not on the direct road to solution is turbulence.

J. T. Hendren, Pan American Airways, Inc., suggested the use of low volatility fuel rather than conventional airplane gasoline as a contribution to safety. He pointed out that although there would still be a danger of fire, the general fire hazard would be greatly reduced. Dr. A. L. Klein, Douglas Aircraft Co., Inc., expressed the opinion that "safety fuels" often are more dangerous than ordinary fuels, since their low vapor pressure, within 6-8% F/A ratio, places them within the explosive range.

Chairman Chamberlain reported a reduction in the number of deaths per hundred million passenger miles to 2.2 in 1945.

O. E. Kirchner, American Airlines, Inc., said that a mistake is made in thinking the installation of safety devices is any answer to the problem. Safety provisions are still the best possible compromise, but it is necessary to fly in the meantime, while better ones are perfected.

John E. Frazer, Transcontinental & Western Air, Inc., suggested that the effectiveness of warning signals should not be overestimated. Since accidents usually are accidents, he said, 98% of the results of any emergency will depend on the wisdom and judgment of the man in charge. In his opinion, speed, comfort and food should always be secondary to safety.

Speed is at least the second most important consideration in aircraft design; future developments may show it to be of first importance. Walther Prokosch, Eastern Air Lines, Inc., in a paper entitled "The Planning of Cabin Interiors for Transport Aircraft," described what is being done and what is contemplated to cut down delay in loading and unloading passengers.

Suggested methods for increasing the efficiency of passenger handling are more and larger entrance doors, aisles of better width, functional positioning of coat closets, luggage compartments, and cabin attendant stations, location of all passenger entrances on the same side of the plane, and reduction of cabin floor height above ground.

John T. Fisher, American Airlines, Inc., suggested that location of coat rooms near doors would considerably slow up loading operations, and expressed the opinion that passengers could not possibly do an efficient job of stowing their own luggage. An attendant is necessary for this purpose, he believes, but passengers should be encouraged to keep smaller bundles with them.

Speed and operating cost are primary considerations in selection of new equipment. At the same time, passenger service must always be considered. L. H. Allen and J. G. Borger, Pan-American Airways, described considerations which determine aircraft selection, pointing out that rate equalization means that airlines compete on the basis either of service or of speed: for this reason, no airline can afford to reject a faster airplane, other factors being equal. Early delivery may mean a competitive advantage for the purchaser of a new design; but, on the other hand, later purchasers receive the advantage of correction of initial operational problems, they wrote in their paper "Transport Aircraft Selection."

Technical ability of a manufacturer's engineering establishment has a great deal to do with his reputation as a supplier of aircraft. Millions of dollars are involved in new investment at the current stage of the industry, so that implicit faith in the quality of the product is essential.

Nontechnical factors involved in the choice of a new aircraft type are Governmental policies, the status of international competition, and any regulation of fares, which would tend to confine competition to the areas of speed and service.

In all the technical factors which enter the picture, the authors reported, there is room for improvement. Increased speeds will increase patronage, lower cost and thus increase revenue. Schedule regularity they believe to be particularly important, since the cost of loss of patronage and other indirect costs are becoming larger parts of total cost.

Chairman Davies asked Mr. Borger whether automobile manufacturers' methods were applicable to the production and selection of aircraft. He suggested that it might be beneficial to produce a prototype three or four years ahead, so that complete testing would be possible before putting any new design into operation. Mr. Borger admitted the value of such an idea from the technical standpoint, but felt that top aircraft executives would be too prone to put anything too new into immediate operation.

Overall speed is the only relevant measure, Charles Froesch, Eastern Air Lines, Inc., said. Thus distance of the airport from town, ground speed and air speed must be added to determine this important characteristic. It may be necessary to sacrifice some speed for nearness.

In answer to a question, the author pointed out that total cost increases with speed, because the energy required to get added speed comes from fuel. He estimated that 23-25% of total operating costs are fuel costs, and that these will increase when aircraft enter the jet field.

Payroll costs were named as one unbalanced item in total cost. On some lines payroll per year is twice the original cost of the plane. Most airlines are still underequipped as far as fixed plant is concerned.

Major developments are taking place in response to specific airline needs for better, cheaper, more dependable planes. Requirements are becoming more specialized; there is a wider and wider gap between the needs of major trunk line operators and feederlines.

Frequent schedules are a prime consideration in feederline operations, it was reported in a paper by J. G. Ray, Southwest Airways Co., presented by Harry Stringer, All American Aviation, Inc. With a useful load of about 15 passengers, and 600-1000 lb of mail and express, he said, fairly frequent scheduling can be supported, with passenger fares kept as low as five cents a mile. Although experience has not been extensive enough in this country to determine at what point a run becomes too short for profit, he estimated the minimum profitable trip to be about 50 miles.

Requisite provisions in the new feeder line plane, he said, are twin engines, with ample single-engine performance; adequate de-icing equipment; complete instrumentation, and improved radio and navigation equipment. Superfluous landings can be eliminated by using pickup gear.

Evolution of a new transport aircraft, M. B. Bassett, Glenn L. Martin Co., reported, has been the result of constant cooperation between airlines and manufacturer. Safety, economy, and passenger comfort have been placed first. Important questions to be answered were the optimum number of engines, best wing loading and power loading, and high or low wing construction.

Low wing planes, the author stated, have the advantage of a greataer percentage of

useful load, and more payload carrying ability. Design is simpler, fuselage lighter, cheaper, easier to build, and lower total operating costs are achieved.

Research has developed special wing construction requiring few ribs, and light in weight, in which rubber cell-type fuel tanks could be installed. Wing, flap and aileron have been combined into a unit which answers to the requirements of airport size, cruising speed, useful load, operating cost and other important factors which depend on it.

At 100% load factor and cruising altitudes of 10,000 ft, he said, minimum direct flying costs of about 5½¢ per ton mile are possible. This indicates a trend toward lower direct costs which may mean eventual favorable competition with rates of other forms of transportation. Turbine-propeller combination which is undoubtedly on its way will cruise at much higher speeds, and will offer lower operating costs than the reciprocating engine plane.

Raymond D. Kelly, United Air Lines, Inc., pointed out that the potentialities for applying gas turbines for high speed airplanes are excellent, but that first we must have planes capable of high speed operation.

J. D. Hungerford and J. W. Colthar reported that from now on the airlines will have to cater to passenger demand as far as timing and type of schedules are concerned, but that they must also plan on high utilization of equipment, in their paper on "Airline Scheduling."

Problems will derive from shifts in the traffic problem, increased problems of air traffic and ground traffic control. The process of scheduling, it was said, begins with an attempt to meet the public demand for volume, frequency and convenience.

Mr. Hungerford said, in reply to a question, that during the war it was impossible to coordinate competing schedules but in normal times conferences are held in the spring and fall when major schedule changes habitually are made.

Aircraft POWERPLANT Sessions

CHAIRMEN

Earle A. Ryder, Pratt & Whitney Aircraft — Almon L. Beall, Wright Aeronautical Corp.
Raymond W. Young, Wright Aeronautical Corp. — Alfred T. Gregory, Ranger Aircraft Engines
Ralph N. DuBois, Packard Motor Car Co.

ACCELERATED powerplant development to meet user demands for greater economy and efficiency and greater realization of the need for cooperation among aircraft, engine, and fuel manufacturers to comply with increasingly stringent criteria, keynoted the Powerplant Sessions.

Although military services, airlines, and personal plane owners all want a reasonably priced plane that operates economically and efficiently, emphasis on engine operational characteristics for each type of aircraft differs. Military airplanes must operate at high speeds and withstand rigorous service. Powerplants for airline usage should be capable of safe, long range operation. Personal aircraft engines should embody simplicity and safety of operation.

Industry is expeditiously exploiting new powerplant advancements to satisfy these requirements and the papers presented emphasized the following means now being explored or pursued for advancement of the art:

1. Joint cooperation of fuel and engine manufacturers in development of fuels and engines for greater operating efficiency;
2. Utilization of two-cycle engines for low-priced personal aircraft;
3. Perfection of bearings by quick and economical laboratory tests;
4. Prestressing of engine parts for longer life and more economical material distribution;
5. Application of German gas turbine developments to similar work in this country;
6. Recovery of reciprocating engine exhaust gases for greater power and reduced specific fuel consumption, and
7. Perfection of centrifugal compressors to better gas turbine performance.

Coordination of joint fuel-engine problems peculiar to military requirements to assure national security was urged by S. D. Heron, Ethyl Corp.

Severe engines having high cylinder and mixture temperatures require relatively insensitive fuels for best performance whereas mild engines operate most efficiently on sensitive fuels. Determination of the most effective type of fuel for military engines should be made, declared R. B. Kerly in presenting his colleague's paper "Fuel Sensitivity and Engine Severity in Aircraft Engines."

Choice of one hydrocarbon for engine design requirements was further emphasized by D. P. Barnard, Standard Oil Co. of Indiana, from the viewpoint of fuel production facilities. For example, if triptane were selected during the war as the most satisfactory hydrocarbon, it would have required more steel for plant construction per barrel than any other type of fuel and would have constituted a serious drain on material, manpower, and transportation during that emergency.

Engine manufacturers, the speaker observed, are generally unaware that virtually all of the 300 possible hydrocarbons within the aviation gasoline boiling range have been tested and evaluated and that there is no sound basis to believe that a super fuel, to withstand still greater engine sever-

y than that presently experienced, can be developed.

Lack of knowledge of available fuels and limitations in fuel synthesis is not entirely the blame of the engine builder, A. L. Beall, Wright Aeronautical Corp., replied. Coordination can be effectively carried out only by release of complete information by fuel manufacturers to engine makers. Another problem is the length of time required to develop new engine features. For example, seven years may be needed in normal times to develop, perfect, and incorporate in a production engine a new cylinder design. By the time that the engine is ready for use, the fuel upon which the design was originally based may no longer be available and new fuels with other performance characteristics may be on the market.

Coordinating Fuel Research engine test methods F-3 and F-4 are inadequate, declared A. L. Pomeroy, Ranger Aircraft Engines, in that they do not provide the engine builder with a complete description of sensitivity characteristics of the prototype fuel.

Criticism of the engine manufacturers was questioned by L. E. Heble, Shell Oil Co., as it was his opinion that engine manufacturers have been accommodating enough in providing engines which will run either severe or mild.

Significance of fuel temperature sensitivity measurement is not fully understood as yet and measurement of engine severity is almost unknown, the speaker indicated, urging greater research and development along these lines to make possible a more intelligent coordinated effort.

Some military authorities, Mr. Heron stated, find the severe engine of outstanding military advantage whereas others prefer the milder performing engine as it can make valuable use of fuels such as triptane. He felt that a decision should be made soon in selection of the most desirable type of engine to guide fuel producers in the manufacture of appropriate gasoline. Prof. G. G. Lamb, Northwestern Technical Institute, advanced the opinion that development of fuels and engines for military aviation should not be placed in a straitjacket.

In conclusion, Mr. Heron recommended an early coordination program, because if the tendency of refiners in the direction of more sensitive fuels is undesirable enginewise, this should be determined as soon as possible.

Joint cooperation of engine, airplane, and fuel and oil manufacturers to insure the future of the personal aircraft field was advocated by C. T. Doman of Aircooled Motors, Inc.

As popularity of the personal airplane increases, the operator will tend to compare the performance of his plane with that of his automobile and, therefore, the airplane and engine producers must use the automobile as a yardstick to minimum oil consumption and reasonable fuel economy.

However, proper lubrication and low fuel consumption, the speaker pointed out in his paper "Fuel and Lubricating Oil Requirements for Personal Planes," are not only a function of the oil and gasoline, but are seriously affected by factors inherent in the engine design. This was illustrated in a number of engine problems allied to oil and fuel selection.

Lubricating oil should demonstrate a number of properties such as the following to achieve satisfactory performance:

1. Permit piston rings to function properly;

2. Create minimum sludge formation;
3. Show no detrimental effects when combined with leaded gasoline, and
4. Eliminate valve sticking.

In considering the first lubricating requisite, it was generally recognized that oil control is to some extent related to piston ring design and cylinder honing. In one case, the speaker demonstrated, improper functioning and limited life of piston rings first thought to be oil troubles, were traced to too smooth honing of the cylinder barrel, permitting a minimum of oil to reach the combustion chamber.

A decided reduction in sludge formation in the combustion chamber and valve guides with no corrosive effects has been attained by using new heavy-duty oils. Heavy-duty oil also satisfies the third provision noted above by largely eliminating the detrimental effects of highly leaded gasoline as it does not form a binder with the lead.

Oil service is severe in light planes, added W. V. Hanley, Standard Oil Co. of California, and heavy oils provide the best solution to the problem. Heavy-duty oil can double the operating period and shows no deleterious effects on valve guides.

Less of a tendency for valve sticking and seating troubles was experienced in tests using SAE 60 oil than SAE 40 oil. A 100 octane fuel with 4 to 5 cc of lead per gal was used in the test.

The importance of economical fuel consumption to the operator can be fully appreciated when it is realized that 58¢ of every dollar for operating the plant is spent for gasoline.

Hazards due to contamination of fuels were noted by Mr. Barnard. Contamination can be insured against only by careful handling. Use of modern equipment by service stations is a prime necessity in providing the airplane with uncontaminated gasoline.

Increased engine efficiency and performance would be realized, Mr. Doman promised, by incorporating such features as geared propeller drive instead of direct drive, supercharging which can increase output by as much as 25 hp, induction heating to eliminate carburetor icing, elimination of excessive temperatures within the cowling and improved induction design to prevent vapor lock, and improved engine cooling to eliminate malfunctions of excessive operating temperatures.

Opposed piston, two cycle engines may be a step in the right direction toward the achievement of a more economical operating and lower priced personal aircraft in the light of presentations by J. L. Ryde and J. W. Oehrli of McCulloch Aviation, Inc.

In a paper "The Crankcase Scavenge Engine," the former described the two-cycle engines developed for small-scale target aircraft used during the war. Potentialities of this engine led to considerable research on an opposed piston engine for civilian application discussed by Mr. Oehrli.

The radio controlled target airplanes with the crankcase scavenge engine were one-fourth scale, launched by catapult, and landed by means of a self-contained parachute. The speaker demonstrated the design features, performance characteristics, and future possibilities of the two-cycle, crankcase-scavenged engine developed for this airplane.

Performance obtained was encouraging, Mr. Ryde revealed. With the 80 octane gasoline, the brake output was 60 hp at 4000 rpm, corresponding to over 68 psi bmep. In answer to a question from A. T. Gregory, Ranger Aircraft Engines, the speaker stated that the highest cylinder head temperature at maximum power and rpm

found to be 360 F, under the spark g, and the cylinder base temperature was than 220 F.

The specific fuel consumption, which s high due to inherent loss of charge in s type of engine, ranged from 0.80 to 2 lb per bhp hr. J. F. Haines, Aeroprods Division, General Motors Corp., inired as to the effect of crankshaft rotanal speeds on fuel consumption and the sibility of installing a controllable pitch opeller to better fuel consumption. Mr. de did not believe that a controllable ch propeller would solve the problem as was not crankshaft rotation that affected l consumption, but rather the comparaely low volumetric efficiency.

In expanding upon this contention in the per "Investigation of an Opposed Piston ght Aircraft Engine," prepared by J. W. hrli and V. J. Jandasek, the speaker dissed the operation and performance of a gle-cylinder experimental engine tested in e laboratory, and also covered the design nsiderations, performance, and description a multi-cylinder engine predicated on the sults of the single-cylinder investigations.

Each cylinder of this engine type conins two opposed pistons connected to parate crankshafts at each side of the gine. Power is transmitted from the ankshaft pinions to a larger propeller gear etween them. The combustion chamber is e space between the pistons. An inlet rt located at one end of the cylinder is ntrolled by the inlet piston and the exust ports controlled by the other piston oviding a uniflow condition. This elimates poppet valves.

In designing a multicylinder engine of is type, several unusual features may be ploited to provide a simple powerplant at is economical to manufacture. Less ston displacement and lower brake mean fective pressure required for a two-cycle gine as compared with a four-cycle engine greatly reduces the mean and maxium forces on all parts. Absence of a reersal load on the connecting rod further duces fatigue stresses. Another factor is e balance for any number of cylinders iminating the need for crankshaft countereights.

The speaker pointed out that the hottest ea in the engine would be just above the haust port and in view of the high temerature value anticipated, blast cooling may e resorted to in the final design.

The large exposed crankcase surface is be covered inside and out with fins to rovide an integral oil cooler. A relatively rge fin area is obtained without excessive n length and attendant foundry costs. M. A. Wachs, Sikorsky Aircraft, doubted at proper cooling could be obtained by cating the cylinders behind the propeller ear housing. He was assured that the ooling factor would be quite high because f the long cylinder and small diameter. Cooling should compare, the speaker noted, ith that of larger engines.

The engine will weigh about 1.52 lb per hp including the ignition, fuel injection quipment, and provisions for starter and enerator drive. The engine has been designed to keep manufacturing costs down o a minimum. The main structure is an ntegral cylinder block casting requiring no omplicated cores and is easily inspected nd cleaned. All other castings are adapted o permanent molds and die casting. All crews are easily accessible and one wrench s needed to assemble the entire engine.

In evaluating the predictions of the multiylinder design based on single-cylinder tests, R. W. A. Brewer advised that the single unit may not be a true indication of actual performance demonstrated by the larger model.

Acceleration of bearing development at a reduced cost by testing bearings in laboratory test rigs to simulate service and evaluate specific properties was reported by J. Palsulich of the Wright Aeronautical Corp.

To reduce time and cost of full-scale engine tests, laboratory test rigs were devised as illustrated in the presentation "Testing of Highly Loaded Sleeve Bearings" prepared by Mr. Palsulich and R. W. Blair, also of Wright, to investigate the following bearing properties:

1. Maximum load-carrying capacity,
2. Friction and lubrication characteristics,
3. Fatigue life,
4. Wear resistance,
5. Corrosion resistance,
6. Cavitation erosion resistance.

The load-carrying test rig uses a bearing similar to the crankpin bearing installed in the production engine. The test bearing is assembled into a bobweight which is carried on a crankpin. The bobweight is kept from rotating by a gear train. The front end of the crankshaft is supported in the test rig cast iron housing and is driven by "V" belts from a variable-speed 30 hp motor. A dive dummy engine driven by a dynamometer is run to check results obtained on the test rig.

Consistently good results have been obtained on a similar master rod test rig at

the Cleveland Graphite Bronze Co., according to H. W. Luetkemeyer.

The next set of bearing properties, friction and lubricating characteristics, are investigated on a machine consisting of four test bearings contained in a housing which floats on the horizontal test shaft. Friction torque is measured by means of a scale at the end of a 20 in. torque arm.

The third property, fatigue life, is evaluated on a rig in which the bearing is deflected by means of a load roller inserted in the bearing bore while the bearing is supported on two power-driven rollers. The test bearing is partially submerged in oil while running.

Wear resistance is tested on a Taber Abraser, a simple rig giving reproducible results that consists of a turntable, that holds and rotates the specimen, and a pair of abrasion wheels which produce wearing action against the specimen.

Corrosion resistance testing is performed on a machine consisting of a steel cup filled with oil in which a steel disc is rotated against three flat bearing specimens. The oil is heated and the temperature controlled by means of a thermoswitch. Test-rig bearing data, the speaker stated, are being collated with full-scale engine tests. Tests revealed that corrosion losses with lead bearing materials were very high as compared to the low corrosion rate of codeposited lead tin material.

The last property discussed, cavitation erosion, results in the physical removal of the bearing material and frequently creates holes through the bearing liner. Mr. Palsulich did not believe that speed effects corrosion as it has never been encountered on the master-rod bearing machine on which unusually high speed tests had been run. On the other hand, service engines operating at low speeds and low loads have shown signs of erosion.

Direct measurement of strain is pointing the way to more economical distribution of material and longer life of engine parts announced R. G. Anderson of the Aluminum Co. of America.

In determining the safe allowable imposed stress value, recognition must be given to residual stress and its influence on allowable imposed stress value. The principal stresses in an operating machine, the speaker demonstrated in his paper "Improving Engine Parts by Direct Measurement of Strain," may be classified as follows:

1. Imposed stress resulting from operating loads;

2. Residual stresses arising on release from non-uniform plastic deformation;

3. Prestresses introduced during assembly; and

4. Thermal stresses set up during operation as a result of thermal gradients.

Imposed stress on a part such as a crankcase section is the result of the explosive pressure in the combustion chamber, creating a principal strain, and unbalanced crankshaft forces generally present, resulting in additional strains. The principal strains can be evaluated by the application of Stresscoat, a brittle lacquer. The additional or secondary strains can be measured biaxially with two gages at each interesting location. After determining the location of the higher strains and their direction with Stresscoat, they can be measured, with the engine in operation, by using strain gages capable of operating at high temperatures.

Residual stress, may be set up during casting, fabrication, heat treatment, machining, or assembly by non-uniform cold working of the material. With the exception of the X-ray method, residual stress determination is destructive to the part. J. D. Pearson of Rolls Royce, Ltd., of England, indicated that highly loaded, ground carburized gears have been giving trouble in service due to surface cracking.

Residual stresses resulting from plastic yield during fabrication or assembly may be beneficial or detrimental to the fatigue life of the machine part, declared Mr. Anderson, depending upon the relation of the residual stress direction to the direction of the imposed stress.

The fourth principal stress, thermal stress, is induced by restraining the normal expansion and contraction accompanying a change in temperature. The speaker illustrated one condition in which the combination of thermal and imposed stresses can result in a fracture at the piston head fillet and indicated a proposed design which shows considerable improvement and results in a 40% saving in weight by allowing for the effect of thermal stresses.

The combination of residual, machining, assembly, and thermal stresses generally functions as a prestress upon which is imposed the stress of the operating load. Mr. Anderson emphasized that stresses cannot be computed vectorily as is possible in dealing with forces.

In summing up his presentation, Mr.

Anderson stated that the criterion of the strength of a design should not be the magnitude of the anticipated stress calculated from the imposed load since economic benefits can be realized by taking advantage of prestress in design.

Countless benefits which accrue to the aeronautical industry through unusual advancements of the Germans in the field of turbojet engines were demonstrated by R. W. Cole, Wright Aeronautical Corp., in his paper "Performance Characteristics of the BMW 003 Turbojet Engine and a Comparison With the JUMO 004," prepared by W. G. Lundquist and Mr. Cole.

Both the BMW 003 and the JUMO 004, although not the latest German designs, were actually in production. In presenting the performance data of both engines, the speaker stressed:

1. Performance of the complete machine;
2. Compressor performance;
3. Combustion chamber performance, and
4. Turbine performance.

The 003 engine consisted of a seven stage axial flow compressor, an annular combustion chamber, single stage turbine, and a variable orifice jet. The compression ratio was approximately 3.1 and the operating temperature approximately 1380 F. Performance curves indicated a declining combustion efficiency above 36,000 ft altitude causing a progressively worse specific fuel consumption with increasing altitude. A. T. Colwell, Thompson Products, Inc., questioned the reason for this decline in efficiency as he understood that jet engines generally operated at increased efficiency at higher altitudes. The speaker replied that this feature was intentional in the 003 engine design. Further, contrary to general opinion regarding jet engines, combustion efficiency does fall off at extremely low pressures.

At a flight speed of 559 mph, the 003 developed a thrust of 1534 lb and a specific fuel consumption of 2.0 lb per hr per lb of thrust. Combustion started between 800 and 1200 rpm and the idling speed was 3000 to 3500 rpm. The engine accelerated from 3500 to 9500 rpm in 11 sec.

The JUMO engine closely resembled the 003 in both performance and design characteristics. The specific weight, fuel consumption, and general efficiency were almost identical, although the JUMO was larger physically and delivered more thrust. The only striking difference between the two was in the combustion chamber design since the 004 had six individual chambers instead of one. Although there was little difference in performance and physical dimensions between the two, the 003 was designed for facile manufacturing, greater operating safety, durability, and high altitude burner performance.

The use of a starting torch for the 003 was described by F. C. Mock, Bendix Aviation Corp. The torch segregated the spark plug from the spray, giving positive starting without hot starting troubles. Mr. Cole explained that the torch was resorted to because of the poor fuels available to the Germans near the end of the war and this was a method of introducing special fuels for the initial start.

Single stage turbines were selected for early models of both engines to minimize the risk of failure. The low compression ratios of these machines were partially the result of this decision. Production models of both engines used a partial reaction type of blading with 20% reaction at the design points. The 003 delivered an output of 64 Btu per lb at 9500 rpm as against the 004 output of 60.3 Btu per lb at 8700 rpm. Efficiencies of 78% were obtained with turbines of both engines. However, this does not reflect the effectiveness of the turbine discharge velocity for operation of the jet.

The turbine, which was the weakest part of the machine, had an operational life of 60 to 80 hr, although its design life was 300 hr. The major cause of the short service life was a combination of excessive vibrations and high thermal stresses.

Recovery of exhaust gases to provide greater power and reduced specific fuel consumption required for the current trend toward increased cruising speed and longer flight range was forwarded by B. Pinkel of the National Advisory Committee for Aeronautics as a means of preserving the future of the reciprocating engine.

If it is conceded that considerable future flying will be done at speeds below 300 rpm, C. F. Bachle, Continental Aviation & Engineering Corp., added, it is obvious that jet reaction will not be used in any form as it is now understood. This means that practically the only means of bettering the performance of present powerplants for aircraft is by combining the conventional piston engine with a turbine driven by exhaust gases to give a compound engine.

Energy reclamation, Mr. Pinkel pointed out in his paper "NACA Study of the Utilization of Exhaust Gas of Aircraft Engines," may be accomplished with an exhaust sys-

tem incorporating discharge nozzles in which a high discharge velocity is generated by virtue of the engine and atmosphere pressure differential. This high velocity gas jet may be utilized for exhaust jet propulsion by directing the gas rearward of the plane or, for provision of turbine power by directing the gas jet at the turbine blades.

Jet propulsion obtained with individual nozzles is the simplest exhaust recovery method. However, a serious objection to individual stacks – particularly for civilian aviation – is the high exhaust noise level.

The exhaust-collector system gives thrust with less noise than individual jet system.

The blow-down turbine, one type of which was built with a nozzle for each pair of cylinders, was designed to impose no increase in engine exhaust pressure as was the case with the steady-flow turbine. Therefore, the blow-down turbine developed substantial turbine power with little loss in engine power.

Greater efficiency of gas turbine performance is closely linked to the development of the centrifugal compressor declared R. S. Hall, General Electric Co.

A logical approach to improved turbine design consists of an appraisal of turbine-compressor relationship that can readily be made by an evaluation of mutual performance characteristics as demonstrated by the speaker in his paper "Aircraft Gas Turbines with Centrifugal Compressors."

The magnitude and relative importance of factors affecting operating conditions are ascertained by construction of a performance map of turbine parameters in the compressor performance field. The mapping is a composite of three fundamental relationships plotted against pressure ratio and standard flow, namely:

1. Compressor rpm = turbine rpm,
2. Compressor flow + fuel flow = turbine flow,
3. (a) Jet engine:
   Compressor power = turbine power,
   (b) Propeller-drive engine:
   Compressor power + propellor power = turbine power.

J. E. Talbert, Wright Aeronautical Corp., stated that he had been using a similar method to estimate performance of a centrifugal compressor and reciprocating engine. He felt that the performance curves obtained by the procedure indicated above could not be used, for all conditions, with great facility in arriving at numerical solutions. Mr. Hall clarified the relative value of these curves by emphasizing that they were not intended for use in final calculations, but rather to serve as a graphical representation of conditions that exist in the engine.

Study of the performance map revealed that a simple fixed-pitch propeller directly coupled to a simple gas turbine will not operate satisfactorily. Another effect noted is that compressor pulsation imposes little or no limitation on the possible range of operation under off-design conditions.

SAE Names Danse As FSB Adviser

SAE Technical Board has announced appointment of L. A. Danse, General Motors Corp., as SAE representative on the Industry Advisory Council of the Federal Specifications Board.

The FSB, created in August, 1945, by Clifton E. Mack, director of the Treasury Procurement Division, and under the chairmanship of Dr. Lyman J. Briggs, director of the National Bureau of Standards, is responsible for preparing, revising and amending purchase specifications decreed by the Procurement Division for supplies used by the executive departments and establishments. Also among its functions are improvement of Federal specifications procedures, development of means of correlating individual agency specifications with Federal specifications, and resolution of controversies which may arise on the drafting of Federal specifications. The FSB aim is to coordinate the requirements of various Government agencies, and thus to reduce the number of standards.

In drafting specifications, the FSB will supervise the work of 74 technical committees, whose membership now is composed of 1300 scientific personnel from various Government offices. Specifications prepared by a committee are to be submitted to recognized technical and professional societies, such as SAE, ASA, ASTM, ASME and others, as well as to representative manufacturers, for comment and criticism.

The Advisory Council on which Mr. Danse will serve has been established to represent the industrial viewpoint in helping to advise the Board on policy questions which may arise between the Government and its suppliers.

APPLICATIONS Received

The applications for membership received between March 10, 1946, and April 10, 1946, are listed below. The members of the Society are urged to send any pertinent information with regard to those listed which the Council should have for consideration prior to their election. It is requested that such communications from members be sent promptly.

Baltimore Section: A. F. Cone, William H. Edmunds.

Buffalo Section: Edward W. Burd, T. James Levell, William Stewart.

Canadian Section: E. T. Miles Barratt, Corlis G. Keyes, Ivan Forbes MacRae, Clifford Fraser McKeown, A. Lawrence North, Arnold Pitt.

Chicago Section: Graham Fairbank, Charles H. Flubacker, Anthony A. George, Raymond M. Houston, Frank L. Monaco, Don Peter, Fred A. Robbins, Vernon W. Wells.

Cincinnati Section: J. W. Grafton, Elmer T. Kramer, George Frank Rose, Cason Rucker, Walter Walkenhorst, Jr.

Cleveland Section: Clifford Harry Allen, William C. Beadle, William F. Billingsley, Theodore N. Busch, Lester C. Corrington, Robert T. Duffy, Myron L. Harris, Robert W. Jones, Robert C. Kohl, John Kenneth Kuezig, Frank E. Macknight, Charles W. Ohly, John D. Peace, Jr., Starr W. Pearn, Ensign Donald G. Rambacher, Lowell O. Ray, Ernest H. Schanzlin, Steve A. Schneider, Earl L. Sherman, Robert W. Smith, Joseph C. Tulloss.

Dayton Section: Arthur Tregoning Cape.

Detroit Section: Merrill J. Anderson, Louis J. Aure, William L. Casterline, Don L. Brown, Albert J. Chendes, Carl W. Cowan, George E. Curtiss, Frank Robert Lee Daley, Jr., Alfred Frank Debicki, Charles P. DeVoss, D. Gerald Domes, William M. Duckwitz, John G. Else, Verner J. Fisher, Edward R. Fitzpatrick, Herbert B. Ford, Fred E. Fricke, Lynden H. Garrison, Gay Paul Gaulien, Henry C. Grebe, William Christian Hahn, Frederick L. Hoelzel, J. C. Huntley, Fred A. Jenness, Raymond G. Johnson, Ray P. Johnson, Lawrence J. Kehoe, Jr., Kenneth E. Koppock, Dewey L. Maker, Robert M. McVeigh, Richard J. Morel, J. Raleigh Nagle, George D. Pence, William D. Pidd, Sherwin S. Post, Ellis John Premo, George Lewis Radamaker, Lawler B. Reeves, John F. Schmidt, John F. Sloan, Michael P. Vengris, Lyle A. Walsh, Robert Edward Zoellner.

Hawaii Section: Kenji Aihara, William H. Bomke, Howard Blanchard Case, Hollis Aiken Hardy, Lt. (jg) H. W. Johnstone, Chew Chung, LeFoy Lowry, James S. Moore, George J. Scheuermann, Frank O. Warmuth.

Indiana Section: Rex. E. Gage.

Kansas City Section: Albert H. Kaiser.

Metropolitan Section: Robert H. Arnold, Saul Berman, Francis A. Breen, Bernard N. Charles, Arthur Leslie Core, Arnold Cowen, Harvey H. Earl, Elwood M. Easton, Jr., Earl W. Estelle, Luigi M. Ferrari, Walter Fly, A. Frank Geiler, Theodore R. Gladstone, Karl H. Guttmann, James T. Harker, Heaton Bennet Heffelfinger, John C. Helies, Ralph E. Hensley, Charles S. Herrmann, Richard Ellsworth Hitchcock, George F. Hunt, Allen H. Kent, Thomas Manning Kiely, Burton A. Knapp, Charles M. Kuhbach, Lt. Robert Lee Maxwell, Robert D. Mellen, Carl M. Mueller, Roy H. Olson, Frank Pagano, George Plevritis, Salvatore C. Provenzano, Joseph Rafton, Milton P. Rashkin, Bruno C. Reciputi, Bernard Schaffer, Whitman J. Severinghaus, Manuel Stillerman, Foster B. Stulen, Thomas C. Tarbox, George William Taylor, Edmund Thelen, James Thomson, Gerald Addison Tobey, Serge Trey, Harry W. Van Horn, Stanley Evert Varner, Orrin J. Whitney, A. Bennett Wilson, Jr., John J. Witmer, Jr.

Milwaukee Section: Trevor Davidson, Harold J. Geder, Gordon Murphy, John R. Parker, Bernard R. Weber.

Mid-Continent Section: Howard W. Bottger.

Mohawk-Hudson Group: Robert G. Shanklin.

New England Section: Chris F. Kimball, Richard H. Lodge, Richard R. Metheany, Jr.

Northern California Section: Elmer D. Grush, Roland J. Morgan, Ernest L. Walters.

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NEW MEMBERS Qualified

These applicants who have qualified for admission to the Society have been welcomed into membership between March 10, 1946, and April 10, 1946.

The various grades of membership are indicated by: (M) Member; (A) Associate Member; (J) Junior; (Aff.) Affiliate Member; (SM) Service Member; (FM) Foreign Member.

Baltimore Section: Ensign Robert Fuller Birdsall (J), John C. Hale (A).

Buffalo Section: R. Theodore Whittleton (A), Carl T. Woznicki (J).

Canadian Section: Charles P. Archibald (A), Charles Carter (A), D. Roy Hornell (A), Rolland Lewis Jerry (J), Stanley John Randall (A), William Morris Shipitalo (J).

Chicago Section: Rodney Owen Cochrane (J), Roger Mack DeLacy (A), William Quine Douglass (J), Arthur E. Gibbs (A), Robert Anderson Lasley (M), Jack Louthan (M), Robert W. Moore (M).

Cincinnati Section: Paul Haines (A), Paul Klotsch (M), Ralph R. Lane (A).

Cleveland Section: John P. Aseff (J), Frank J. Barina (J), Joseph J. Berdysz (J), Richard J. Carleton, Jr. (J), Trevor Fink (J), Robert D. Fisher, Jr. (J), Donald F. Horsburgh (J), Sidney E. Hotchkiss (M), John Edward Knoblock (J), Seymour Lieblein (J), Gilbert J. Monigold (J), Bud W. Pasnow (M), Alvin A. Rood (J), William Boyd Watterson (A).

Dayton Section: Donald Dunham Herman (M), Gene T. Neudeck (J).

Detroit Section: Joseph Charles Brabetz (J), Eugene S. Clark (J), Robert P. Clifton (M), Jack P. Cummings (M), Hiralal Sitaldas Dalal (J), N. B. Dicken (M), Manuel H. Elkin (M), John W. Fedack (A), James Robert Ferguson (M), J. B. Gates (A), John Erwin Henn (A), Levi Lithgow Henry (M), Richard L. Hinch (M), William C. Liskow (A), Donald Raymond Long (J), Harvey G. Moore, Jr. (A), George Andrew Rives (M), John T. Spitler (A), Frank A. Swindell (M), Harry Westland (M), Ralph A. Wilhelm (A), Fred E. Williams (A), John R. Woodside (J).

Hawaii Section: Jack R. Doolittle (A), Charles A. Harker (A), Eugene George McKibben (M), Mortimer Hitter Moores (J), Carleton Henry Morrison (A), Robert D. Purves (A).

Indiana Section: Floyd James Boyer (J), John Jacob Gambold (J), Harold Hale Hall (A), John B. Hiday (M), James Earl Yingst (J).

Kansas City Section: William W. Carter (A).

Metropolitan Section: Capt. Adnan Alpan (M), Arthur John Bennett (J), Gustave David Cerf (M), Harry Joseph Fisher (A), Charles B. Gale (M), Joseph Sydney Hartle (M), Arthur W. Lewis (M), David H. Moore, Jr. (J), Max Novak (A), Arthur O. Randall (SM), Noel Urquhart (M), Christian M. Vogrin (J).

Mohawk-Hudson Group: Maurice J. Collins (J).

Mid-Continent Section: George F. Racette (A).

Milwaukee Section: Robert Le Feber Feind (A), Donald E. Lewis (J).

New England Section: William James Gaugh (J).

Northern California Section: John R. Lambrecht (A), Robert A. McCloud (M), Paul F. Murphy (A), J. M. Scott (A).

Northwest Section: Lt. Walter M. Mason (A).

Oregon Section: Ensign Erland Victor Hill (J), Thomas McLoughlin (A), John Van Wagenen (A), Carl Leon Willett (A).

Peoria Section: Alfred W. Sieving (J), Walter Swardenski (A).

Philadelphia Section: Charles Oscar Bird (M), Lewis Alden Estes (A), John P. Landis (J), Elmer Latshaw (M), Paul Ribanyi (M).

Pittsburgh Section: Watson C. Adams (M), Peter Richard Weihsmann (J).

Southern California Section: Wm. K. Bowman (A), Richard E. Calkins (A), Ralph John Coles (A), Presley Dawson (A), Kenneth L. Fox (A), A. E. Isham (M), Lawrence C. Jones (M), Yuan C. Lee (J), Dave Ian Marlow (J), E. R. Proctor (A), Miss A. Virginia Rowley (A), Austin Graham Silvester (J), Kenneth T. Sprague, Jr. (J), William A. S. Wright (M).

Syracuse Section: Israel Katz (J).

Virginia Group: W. Wirt Barker (M), William C. Miller (A), Herbert Dewey Traylor (A), Frank W. Webber (A).

Washington Section: G. Frederick Blackburn (SM), Edward John Eyring (J), Lt.-Com. Julius Kendall (J), Henry L. Prince (SM), Scott Rethorst (J).

Wichita Section: John Alfred Stern (J).

Outside of Section Territory: J. Ardis Barten (A), Lt.-Com. Charles A. Bender, Jr. (SM), Lt. (jg) Francis Wm. Davidson (J), Lorne W. Hamilton (A), J. H. Hutcheson (A), Frank Alfred Jones (M), George W. Lowe (A).

Foreign: Alf. Lysholm (FM), Sweden; Julio Trinchero (A), Brazil; Henry George Turner (FM), England; C. A. Wood-Collins (FM), England; Gerard Young (FM), England.

Applications Received

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Northwest Section: Charles F. Bartley, John B. Hanson, Albert O. Hinsch, Arthur W. Leggett, Roy O. Reime.

Oregon Section: Edward Neubauer.

Peoria Section: William L. H. Doyle, Charles Phillip Brooks.

Philadelphia Section: Ralph Gallo, Edmund F. Higgins, Frank Budd Hineline, Jr., Robert Joseph Reid.

Pittsburgh Section: J. Louis Bossart.

St. Louis Section: W. S. Rigby.

Salt Lake City Group: William H. Wilson.

Southern California Section: Francis N. Beauvais, Theron F. Brown, Edward Reilly Devine, Walter K. Flower, Charles Foster Glaspell, Jr., Gene Grindstaff, Halbert Ivan Hickman, Galen A. Holcomb, A. Allen Johnson, Elmer A. Johnson, Benjamin Harrison Linville, Donald R. Moran, Harry D. Percy, O. B. Shaw, Alfred M. Smolen, J. H. Quigley, James A. Waugh.

Southern New England Section: Mario Louis Carangelo, Ben Min Lee, Harry D. Martin.

Syracuse Section: Burton A. Purdy.

Twin City Section: Stuart B. Haessly, Lewis S. Plett, Arlan A. Schonberg, W. Evert Welch.

Washington Section: Norman L. Klein, William Gipson Rohr, Com. Wendell Wood Suydam.

Wichita Section: Charles V. Chenault, Royce Edgar Means, Ewald William Nath, E. C. Roth, Hobard A. Slingsby.

Williamsport Group: Watson F. Boyer, Carl C. Spangenberger.

Outside of Section Territory: Victor J. Barclay, C. B. Beaird, Fred P. Clark, E. H. Holloway, John F. Puro, Alfred John Robbins, Carl Ray Stevens, Leo F. Swoboda.

Foreign: Leslie F. Atkinson, England; Armand Brasquet, Argentina; Jacques M. Camusat, France; Capt. John Cedric Coates, England; John Glyn Davies, England; Michael Bruce Urquhart Dewar, England; Stanley Bertram Hartshorne, England; Ivan Charles De Martonfalvy, England; James Hector MacDonald, India; Rudolf Podsednicek, Czechoslovakia; Bernard Albert Raven, England; Alex Elliot Redhead, India.

Tractor Fuels

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Coordinating Research Fuel Committee of the Coordinating Research Council at the request of the TWEC.

Test results indicated that economy improved 2% by weight and 4% by volume upon increasing the octane number from 30 to 50 for light fuels. Regular fuels showed approximately 5% poorer economy than the light grade and a general trend toward improved economy with an increased octane number. Greatest percentage of power increase occurred in the lower octane ranges for both light and regular fuels. "Knock rating" characteristics exhibited by both fuels indicated that the engines tested were "tailored" to a fuel with an octane number between 30 and 40 as the intensity of the knock in that range was medium to light. An improvement in performance in terms of brake mean effective pressure was obtained with an increase in volatility for a fixed octane rating.

On the basis of the data obtained, the following fuel classifications were developed:

	10% Distillation	95% Distillation	Octane No.
Tractor Fuel—Light	230 F — 347 F	437 F — 464 F	40 min
Tractor Fuel—Regular	347 F — 401 F	464 F — 518 F	40 min

The above proposed fuel classifications have been submitted to the American Petroleum Institute to determine their availability. It is anticipated that tractor manufacturers will recommend the proposed fuel classifications in their instruction manuals.

Tractor Tires

cont. from p. 23

The committee is now in the process of completing a list of some 34 tire sizes in several section diameters including the following rim diameters: 24, 26, 28, 30, 34, 38, and 42 in. Present plans include the establishing of a recommended Future Design Practice and studying the ply and tread requirements of those sizes on the present tentative proposal.

Greater interest of tire manufacturers in the production of cane and rice field tires and the lack of knowledge of requirements for such operations has stimulated the committee to consideration of the problem.

A study of larger tires for proper flotation is one of the subjects under immediate discussion. A variety of tires now in use in the field is not giving satisfactory service. Preliminary study indicates that tread design for rice field usage should differ from cane field tire treads as rice straws plug up the design whereas cane straws do not.

The committee is collecting data from tire companies on a proposed list of sizes and costs and will conduct a thorough survey of dealers and extensive users to evaluate the extent of utilization of these tires in the field.

Soil Testing

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scale model track plate equipped with grousers. It was revealed that the ultimate shear value of a confined soil is in a plane parallel to the grouser tips and unconfined soil shear occurs at approximately 45 deg.

Density is a measure of soil bearing power and this property, in effecting vehicle penetration, appears to be an important consideration in studying flotation.

Cohesion, the fourth soil property, is that ability of soil particles to be bound together by water films. It is closely related to plasticity and shear value of soil. Highly plastic clay soils, for example, have higher shear values than low plastic sandy loam soils.

The last important property, adhesion, is a charactertistic effecting shear value which causes soil to stick to foreign objects and occurs when the soil is so loosely held by

the soils' surface that the attraction of another surface, such as a tank track, will overcome moisture and cause the soil to stick to the track.

Inasmuch as a more thorough study of soil dynamics is still needed before sound engineering principles can be developed in the design of tracks, tires, and suspensions, controlled soil, model and full scale testing will be continued by the Army with the aid of the SAE Controlled Soil Testing Committee of the TTC.

Ramblings

cont. from p. 25

service. William Nostrand, Winslow Engineering Co., pointed out that proper filtering of fuel can increase useful life of lubricating oil 25%, since it removes moisture and gum accumulated en route from refiner to engine, and thus prevents plugged filters.

Ernest V. Berry, Hard Chrome Engineering Co., reported excellent results in the application of chrome plating to details of automotive maintenance. Worn crankshafts, he said, can be built up by chromium plating for about one-fourth the cost of a new shaft, with better bearing qualities than the original shaft. Chrome plating, he said, is believed to eliminate the cause of much bearing wear. It has made possible the surprisingly long performance of Navy guns, and the durability of stamping dies.

HAWAII SECTION is now well on its way to solving the organizational problems connected with its extensive territory. More papers are expected soon, and more meetings of a technical nature. February meeting was attended by 62 members and guests who heard Dr. Gregg M. Sinclair, president of the University of Hawaii, discuss plans for an expanded study program, and describe the advanced Pacific and Asiatic research which is contemplated in response to the expected growth of the trade and travel importance of the Islands. He reported that the Hawaiian Sugar Planters Association has granted the University $100,000 to expand its agricultural engineering courses.

At the Section's March 18 meeting, J. A. Malloy read a paper by C. F. Kettering on higher engine fuel efficiencies. William Sheehan, vice-president and general manager of the Hawaiian Equipment Co., reported that the changeover to canehauling by truck has led to greatly increased efficiencies, because of larger sized vehicles, specialized loading and unloading devices, and the addition of front drive.

Highway safety and its "Three E's"—Engineering, Education, and Enforcement—were analyzed by Rudolph F. King, at **NEW ENGLAND SECTION** meeting, April 2. Mr. King, who is registrar of motor vehicles for the Commonwealth of Massachusetts, demonstrated his thorough knowledge of the subject by his skillful use of facts and figures in what was reported as an excellent speech. Special guests were Virgel D. White, commissioner of motor vehicles for New Hampshire, William H. Kirley, director, Massachusetts Department Public Utilities, Frederick N. Clark, road toll administrator for New Hampshire, and A. J. Boardman, vice-president and general manager of the Eastern Massachusetts Street Railway.

Parts makers, according to Joseph Geschelin, Detroit Editor of Chilton Co., are the larger part of the automotive industry. Speaking before **WESTERN MICHIGAN**

SECTION, Mr. Geschelin reported that many improvements originate with parts manufacturers who maintain large engineering and research staffs for the development and improvement of parts such as pistons, rings, valves, starters, generators, and so on.

Radical changes may come about through the impetus of new competition, he said; the time is ripe for major changes, and the new manufacturers must take a chance on public approval. Most important changes, in his opinion, will come in engines, with fuels and engine designs coordinated for doubled power per cu in. displacement. Trend in heavy duty engines, he said, is toward overhead valve arrangements. This engine is particularly adaptable, since a change in the cyl head to one of different combustion chamber design makes it possible to use it as a diesel or to run it on gasoline or butane fuel.

Many instances in which styling has controlled the design of automobiles were cited in a paper prepared by Howard A. Darrin, stylist, who recently did the Kaiser-Frazer designs, read by Walter T. Fishleigh at the March 25 **DETROIT SECTION** meeting. At the same time A. G. Herreshoff, chief engineer, development design, Chrysler Corp., formulated an interesting and informative line of thought about the evolution of the modern automobile.

Wider use of improved power brakes on heavily loaded vehicles to achieve faster schedules with safety was the important theme discussed at the **CHICAGO SECTION** April 9 meeting by J. George Oetzel, consulting engineer of the Warner Electric Brake Mfg. Co. Mr. Oetzel analyzed the present problem of heavy-duty commercial vehicle braking, explaining that even with the largest brakes it is possible to apply on big tonnage units within the space limitations of design, it is more and more difficult to hold speeds within safe limits on long grades and still be able to stop with proper control at the bottom.

"With almost unlimited horsepower available," he pointed out, "higher speeds with heavier loads are being called for in highway transport, thus making the need for larger, adequate brakes a major problem." Although initial cost of these larger brakes will be high, he said, maintenance cost will be reduced. Supplementary brakes for mountainous country will add further to cost, but at the same time will cut maintenance and permit faster, safer schedules with consequent increased earnings. Operation of this brake should be as nearly automatic as possible, and its control distributed over as many axles as possible.

The need for synchronization of eddy current type brakes, for developing low cost braking capacity on heavy vehicles for high speed operation, and for better vehicle supervision to prevent increased accidents of old vehicles now in operation, were stressed in discussion following Mr. Oetzel's paper.

Section Chairman Emil Wirth then introduced Al Winkler, Bendix Aviation Corp., chairman of the Section's membership committee, who reported a 100% record by the committee this year.

Gear designs has a tremendous influence upon gear production, it was reported at **SOUTHERN NEW ENGLAND SECTION** meeting, March 6, by George H. Sanborn, chief field engineer, Fellows Gear Shaper Co. In fact, he said, many of the current designs make production of the gears almost impossible. This indicates a need for approval of a design for production by the gear manufacturer before parts are released. He described tooth cutting and finishing operations, reporting increasing prevalence of shaving before hardening. Simplest gear inspection machine, he said, is the "Red Liner." The work is rolled on centers with a master gear, and the change of center distance recorded: variations in center distance indicate an inaccurate gear.

Standing spires and churches in former industrial centers in Germany were a sure sign of careful American AAF pinpoint bombing, George G. Mize, chief engineer of Diamond Chain and Mfg. Co., reported to **INDIANA SECTION**, March 21. Mr. Mize, as a member of the Technical Industrial Intelligence Committee of the WPB, helped carry on the industrial evaluation program requested by the Allied Military Council after V-E Day. His investigations, he said, uncovered very little in the chain power transmission industry that would be found of value by American industry of this type. This industry in Germany was concerned largely with production of bicycle and motor cycle chains for export, made in many small plants. Although many of the production machines are ingenious, sturdy, and well designed for ease of inspection and adjustment, he said, rate of production was very low.

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